## Natural Gas DA

### AT: Other Countries Flaring

#### Global flaring is declining – the US is a unique threat

IPS 12 [Inter Press Service]

(U.S. Outlier in New Push to Reduce Gas Flaring, www.ipsnews.net/2012/10/u-s-outlier-in-new-push-to-reduce-gas-flaring/)

Since a major new push began in 2005, the World Bank-led Global Gas Flaring Reduction (GGFR) partnership estimates that, through 2011, its actions have brought down gas flaring by 20 percent, eliminating around 274 million tonnes of carbon dioxide emissions. But according to the GGFR – a coalition of 20 major oil companies and 19 countries – which started a two-day high-level meeting in London on Wednesday, both the economic and environmental impacts of gas flaring require far greater reductions. “A 30 percent cut in five years is a realistic goal,” Rachel Kyte, the World Bank’s vice-president for sustainable development, said in a statement Wednesday. “Given the need for energy in so many countries – one in five people on the planet are without electricity – we need to raise our ambition. We simply cannot afford to waste this gas anymore.” Oil producers resort to flaring when gas, a by-product of oil, is brought up to the surface but cannot easily be repurposed for consumers. Instead, producers simply burn off the product, the value of which the World Bank, based here in Washington, puts at some 50 billion dollars a year. The total amount of gas estimated to have been flared last year, about five trillion cubic feet, is said to equal the amount of natural gas used in the United States over a full year. Environmentalists have long called for the outright banning of the practice, though flaring does in fact release far lower levels of greenhouse gases than simply allowing the gas to evaporate. However, the process does not deal with one notorious pollutant, nitrogen oxide, and still releases significant carbon dioxide, and thus significant greenhouse gas-related worries remain. Alternative uses for this gas range from producing power, refining it for use in local markets, or even putting it back into the ground. But analysts say the economic benefits for companies in doing so are low. Nonetheless, the World Bank reports slow but steady success in reductions, particularly since 2005. According to data released Wednesday, Mexico has cut its flaring by two-thirds and Azerbaijan by half in just two years, while Kuwait gotten its flaring down to just one percent of previous levels. In addition, Qatar and Congo have been singled out for using the gas to make electricity. Significant improvements have also been seen in many of the world’s worst flaring offenders. “Huge investments” by GGFR partners have reportedly helped Nigeria to reduce its flaring by nearly a quarter through 2011, while Russia, the most significant culprit in this regard, has reduced flaring by around 40 percent, though those figures rose last year. (Data on the world’s top 10 gas flarers can be found here.) Still, on Wednesday the bank warned that both of these countries, particularly Russia, in addition to Mexico, Iraq and Kazakhstan, need to make significant improvements. U.S. tripling Missing from this list, however, is one of the most significant outliers in the global push against gas flaring: the United States, which has increased its gas flaring by more than three times since 2007, more than any other country.

#### Other major flaring countries are cracking down

VOA News 12

(7/3, Nigeria Mulls Gas Flare Crackdown, www.voanews.com/content/nigeria-mulls-gas-flare-crackdown/1360704.html)

Komonibo says by the end of the year new legislation in Nigeria is expected to permanently ban flaring. But activist groups say the practice was banned first in 1969 and again 10 years later. Even this year, a Nigerian judge declared flaring illegal, saying it is a violation of the people's rights. Activist group "Justice in Nigeria Now" says for decades oil companies have been paying nominal fines to circumvent bans. The World Bank says gas flaring accounts for a third of Nigeria's carbon emissions and about 1.2 percent of carbon emissions worldwide. Nigeria is second only to Russia in terms of the volume of gas flared off yearly. Nigeria is also second only to Russia in terms of the reduction of flaring between 2005 and 2010. Royal Dutch Shell, the largest oil company in Nigeria says it has reduced flaring by 60 percent over the past nine years.

### Flaring Causes Ozone Depletion

#### Flaring depletes the ozone layer – causes warming

Daily Trust 08

(Nigeria: Gas Flaring in the Niger Delta and Its Health Hazards, allafrica.com/stories/200803100319.html)

Gas flaring also contributes to ozone depletion and this leads to the exacerbation of the problem of global warming. CFCs or chlorofluorocarbons are the primary cause of ozone depletion. When industrial processes release these chemicals, they rise into the atmosphere and degrade the ozone layer. Gas flaring, not only in the Niger Delta, but also in Nigeria is highly inefficient and releases large amount of methane which has very high global warming potential. Other green house gasses include carbon dioxide etc.

#### Flaring depletes the ozone – ensures environmental disaster

Orient Energy Review 12

(4/19, Gas Flare: Still A Burning Issue, www.nigerianorientnews.com/?p=1203)

Learned findings have revealed that the depletion of the ozone layer, of which gas flare is a major contributor, is primarily responsible for the recent rise in temperature. The instability of power supply in the country compounds the situation as families who ordinarily would have made use of their electric fans and air conditioners unhappily suffer the excruciating torture of the hot weather, both in the afternoon as they work in the field, and at night as they go to bed. Immediate economic gains by some multinational companies and debilitating national and international politics seem to have eclipsed the import of the message to save the planet earth for its inhabitants and future generations, especially in Africa. Tailored against the so-called third world countries more often than not, the story of man’s inhumanity to man appears to be retold by the real life situation of our country with respect to the attitude of some multinational oil companies resident in our communities. Yet, there are no encouraging signs that those saddled with the responsibility of protecting our environment are contemplating any positive proactive measures to end gas flaring in Nigeria. The dangers of gas flaring are enormous to humans and their environment because gas flares destroy natural resources, alienate people from their land, impair human health and adversely affect human developmental conditions. A 2005 report on Bayelsa, published by the Climate Justice Programme and Environmental Rights Action/Friends of the Earth Nigeria, quantitatively calculated the yearly health impacts from gas flares and warned that the particulate matter and benzene emissions from gas flaring at the 17 onshore flow stations in Bayelsa alone could cause, each year, at least 49 premature deaths, 4,960 respiratory illnesses among children, 120,000 asthma attacks, and eight additional cases of cancer. Local rural dwellers have reported numerous other consequences such as red eyes, near absence of darkness, corrugated roofs corroding more quickly, constant noise from gas flares, and regular cracks on houses due to ground vibrations caused by gas flares. The worst of it all is that residential homes are located close to some gas flares to such an extent that their nights are hardly differentiated from their day because of the intensity of flame. A curious erudite mind once questioned how people in such area could make babies in such heavily lighted environment

### Ozone Impact – Extinction

#### Ozone depletion massively increases exposure to ultraviolet radiation - extinction

Greenpeace in ‘95

(“Full of Homes: The Montreal Protocol and the Continuing Destruction of the Ozone Layer, http://archive.greenpeace.org/ozone/holes/holebg.html)

When chemists Sherwood Rowland and Mario Molina first postulated a link between chlorofluorocarbons and ozone layer depletion in 1974, the news was greeted with scepticism, but taken seriously nonetheless. The vast majority of credible scientists have since confirmed this hypothesis.

The ozone layer around the Earth shields us all from harmful ultraviolet radiation from the sun. Without the ozone layer, life on earth would not exist. Exposure to increased levels of ultraviolet radiation can cause cataracts, skin cancer, and immune system suppression in humans as well as innumerable effects on other living systems. This is why Rowland's and Molina's theory was taken so seriously, so quickly - the stakes are literally the continuation of life on earth

#### Ozone depletion disrupts food chains - extinction

Sagan and Turco 90

(Carl, David Duncan Professor of Astronomy and Space Sciences at Cornell, and Richard, Professor of Atmospheric Sciences at UCLA, “A Path Where No Man Thought: Nuclear Winter and the End of the Arms Race”, p. 58)

Ozone depletion threatens the food chains on which almost all life on Earth depends. In the oceans, there are tiny microscopic plants, called phytoplankton, which are highly vulnerable to increases in ultraviolet light; and which, directly or indirectly, other animals in the marine food chain including humans—eat. Land plants, including crops, are also vulnerable to increased ultraviolet light, as are most microbes, including those essential for the food chain. (Ultraviolet lamps were once used in hospital operating rooms to kill potential disease microorganisms.) We are far too ignorant of the global ecological interactions to understand fully what propagating biological consequences an assault on the ozone layer would entail (refs. 4.10, 6.3). But it doesn't take a great depth of understanding to recognize that if you rip up the base of the food chain, you may generate a disaster among the beings that totter precariously near the pinnacle. Recovery of the ozone shield would probably take several years. By then enormous damage would have been wrought.

## Renewable Tradeoff DA

### **Renewable Tradeoff DA 1NC**

#### Renewable energy development is increasing now – cost competitive

U.S. Department of Energy, 14 (2014, U.S. Department of Energy, Energy.Gov, “Clean Tech Now,” <http://energy.gov/clean-tech-now>)

America’s energy landscape is undergoing a dramatic transformation. According to a new Energy Department report, falling costs for four clean energy technologies -- land-based wind power, solar panels, electric cars and LED lighting -- have led to a surge in demand and deployment.¶ The numbers tell an exciting story: America is experiencing a historic shift to a cleaner, more domestic and more secure energy future. That clean technology revolution is here today -- and it is gaining force.¶ Read the report Revolution Now: The Future for Four Clean Energy Technologies¶ Watch a video from Secretary Ernest Moniz and learn more about the report¶ Read Secretary's Moniz blog post about the report and the Clean Tech Revolution¶ WIND ENERGY¶ Wind energy is the fastest growing source of power in the United States, creating jobs opportunities for thousands of Americans and boosting economic growth. In 2012, U.S. wind capacity topped 60 GW, enough energy to power more than 15 million homes.¶ America's Wind Industry Reaches Record Highs¶ Wind Farm Growth Through the Years¶ Blades of Glory: Wind Technology Bringing Us Closer To a Clean Energy Future¶ Energy 101: Wind Turbines¶ RESIDENTIAL SOLAR¶ The U.S. is on the verge of a major shift to solar energy, putting a clean, renewable energy source within reach of the average American family. In 2012, rooftop solar panels cost about 1 percent of what they did 30 years ago, and deployment is skyrocketing.¶ Top 6 Things You Didn't Know About Solar Energy¶ Energy 101: Solar Photovoltaics¶ Energy Department Support Brings Game-Changing Advancements in Solar Energy¶ Finding Solutions to Solar's Soft Cost Dilemma¶ Solar For Milwaukee, By Milwaukee¶ ELECTRIC VEHICLES¶ Before 2010, there was effectively no demand for electric vehicles. In 2012, Americans bought more than 50,000 plug-in electric vehicles (PEVs). And with battery costs falling more than 50 percent in the last four years, 2013 is set to be another banner year for PEVs. In the first half of 2013, Americans doubled the number of PEVs they purchased compared to the same period in 2012, and last month, PEV sales reached a new record high. More than 11,000 PEVs were sold in August 2013 -- that's a 29 percent improvement in sales over the previous monthly record.¶ Top 10 Things You Didn’t Know About Electric Vehicles¶ The eGallon: How Much Cheaper Is It to Drive on Electricity?¶ Visualizing Electric Vehicle Sales¶ Energy 101: Electric Vehicles¶ LED LIGHTING¶ Unlike traditional incandescent bulbs, LED lighting generates more light than heat and lasts as much as 25 times longer. Once an expensive niche product, LED bulbs are becoming an affordable choice for Americans looking to reduce their electric bills. In 2012, about 49 million LEDs were installed in the U.S. -- saving about $675 Switching entirely to LED lights over the next two decades could save the U.S. $250 billion in energy costs and avoid 1,800 million metric tons of carbon pollution.¶ million in annual energy costs. ¶ Top 8 Things You Didn’t Know About LEDs¶ LED Lighting¶ Bright Lights and Even Brighter Ideas¶ Energy 101: Lumens¶ A Winning Light Bulb With the Potential to Save the Nation Billions

#### Lowered natural gas prices doom renewable development

Inglesby, 13(6/13, Tommy I., “Shale Gas and Tight Oil: Framing the Opportunities and Risks,” <http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0CB8QFjAA&url=http%3A%2F%2Fwww.mckinsey.com%2F~%2Fmedia%2Fmckinsey%2Fdotcom%2Finsights%2Fgrowth%2Fus%2520game%2520changers%2Fmgi_us_game_changers_full_report_july_2013.ashx&ei=RjirU_3wLJCgogSWw4H4CQ&usg=AFQjCNF_XoWpmxpwUioKndxlGSeptnED3w&bvm=bv.69837884,d.cG>)

In utility-scale generation, the development of renewables is currently dependent on policy incentives. The economics of wholesale electricity are such that renewables cannot compete with natural gas when it is below $9 per MMBtu without the support of federal investment and production tax credits or state-level renewable portfolio standards.26 This is true even for the lowest-cost renewable energy sources, such as onshore wind in the best-endowed areas of west Texas and Iowa. Despite falling gas prices, the share of wind in US power generation has risen from 1.3 percent in 2008 to 3.5 percent in 2012; solar has grown even faster, though from a small base. But there is a risk that policy support for renewables may be scaled back when natural gas prices are low. North Carolina and Colorado, for instance, have even debated measures to lower mandates or broaden the scope of acceptable sources to meet renewables targets.

#### Renewable energy development is key to solve warming

Union of Concerned Scientists 11 (5/9/11, Union of Concerned Scientists, “Renewable Energy Likely to Become Dominant Climate Change Solution by 2050, U.N. Study Concludes,” <http://www.ucsusa.org/news/press_release/renewable-energy-likely-climate-solution-0539.html>)

Renewable energy is likely to become the world’s dominant climate change solution by the middle of the century, according to a new study by the United Nations’ Intergovernmental Panel on Climate Change (IPCC). It has the potential to be more competitive than nuclear power, fossil fuels with carbon capture and storage and other low-carbon energy options across a majority of the scenarios analyzed for the report.¶ More than 160 scenarios were examined for the study, with the most optimistic suggesting that almost 80 percent of the world’s energy supply could come from renewable sources by 2050, although that could occur only with government policies supporting deep cuts in heat-trapping emissions. The report also concluded that the technical potential of renewable energies is 20 times greater than what global demand for energy is projected to be in 2050.¶ If the full range of renewable technologies were to be deployed, levels of heat-trapping emissions could be kept to concentrations lower than 450 parts per million. This level could help keep global temperatures from rising more than 2°F from current levels, the temperature beyond which scientists have predicted would likely lead to the most serious consequences of climate change.¶ The report points out that the renewable energy transition is already underway. Nearly half of new electric generating capacity added globally in both 2008 and 2009 was from renewable sources. The same was true in the United States, with wind, solar, and other renewable technologies providing more than 40 percent of the new generating capacity.

#### Warming is real, anthropogenic, and threatens extinction

Richard Schiffman 9/27/13, environmental writer @ The Atlantic citing the Fifth Intergovernmental Panel on Climate Change, “What Leading Scientists Want You to Know About Today's Frightening Climate Report,” The Atlantic, http://www.theatlantic.com/technology/archive/2013/09/leading-scientists-weigh-in-on-the-mother-of-all-climate-reports/280045/

The polar icecaps are melting faster than we thought they would; seas are rising faster than we thought they would; extreme weather events are increasing. Have a nice day! That’s a less than scientifically rigorous summary of the findings of the Fifth Intergovernmental Panel on Climate Change (IPCC) report released this morning in Stockholm.¶ Appearing exhausted after a nearly two sleepless days fine-tuning the language of the report, co-chair Thomas Stocker called climate change “the greatest challenge of our time," adding that “each of the last three decades has been successively warmer than the past,” and that this trend is likely to continue into the foreseeable future.¶ Pledging further action to cut carbon dioxide (CO2) emissions, U.S. Secretary of State John Kerry said, "This isn’t a run of the mill report to be dumped in a filing cabinet. This isn’t a political document produced by politicians... It’s science."¶ And that science needs to be communicated to the public, loudly and clearly. I canvassed leading climate researchers for their take on the findings of the vastly influential IPCC report. What headline would they put on the news? What do they hope people hear about this report?¶ When I asked him for his headline, Michael Mann, the Director of the Earth Systems Science Center at Penn State (a former IPCC author himself) suggested: "Jury In: Climate Change Real, Caused by Us, and a Threat We Must Deal With."¶ Ted Scambos, a glaciologist and head scientist of the National Snow and Ice Data Center (NSIDC) based in Boulder would lead with: "IPCC 2013, Similar Forecasts, Better Certainty." While the report, which is issued every six to seven years, offers no radically new or alarming news, Scambos told me, it puts an exclamation point on what we already know, and refines our evolving understanding of global warming.¶ The IPCC, the indisputable rock star of UN documents, serves as the basis for global climate negotiations, like the ones that took place in Kyoto, Rio, and, more recently, Copenhagen. (The next big international climate meeting is scheduled for 2015 in Paris.) It is also arguably the most elaborately vetted and exhaustively researched scientific paper in existence. Founded in 1988 by the United Nations and the World Meteorological Organization, the IPCC represents the distilled wisdom of over 600 climate researchers in 32 countries on changes in the Earth’s atmosphere, ice and seas. It endeavors to answer the late New York mayor Ed Koch’s famous question “How am I doing?” for all of us. The answer, which won’t surprise anyone who has been following the climate change story, is not very well at all. ¶ It is now 95 percent likely that human spewed heat-trapping gases — rather than natural variability — are the main cause of climate change, according to today’s report. In 2007 the IPCC’s confidence level was 90 percent, and in 2001 it was 66 percent, and just over 50 percent in 1995. ¶ What’s more, things are getting worse more quickly than almost anyone thought would happen a few years back.¶ “If you look at the early IPCC predictions back from 1990 and what has taken place since, climate change is proceeding faster than we expected,” Mann told me by email. Mann helped develop the famous hockey-stick graph, which Al Gore used in his film “An Inconvenient Truth” to dramatize the sharp rise in temperatures in recent times. ¶ Mann cites the decline of Arctic sea ice to explain : “Given the current trajectory, we're on track for ice-free summer conditions in the Arctic in a matter of a decade or two... There is a similar story with the continental ice sheets, which are losing ice — and contributing to sea level rise — at a faster rate than the [earlier IPCC] models had predicted.”¶ But there is a lot that we still don’t understand. Reuters noted in a sneak preview of IPCC draft which was leaked in August that, while the broad global trends are clear, climate scientists were “finding it harder than expected to predict the impact in specific regions in coming decades.”¶ From year to year, the world’s hotspots are not consistent, but move erratically around the globe. The same has been true of heat waves, mega-storms and catastrophic floods, like the recent ones that ravaged the Colorado Front Range. There is broad agreement that climate change is increasing the severity of extreme weather events, but we’re not yet able to predict where and when these will show up. ¶ “It is like watching a pot boil,” Danish astrophysicist and climate scientist Peter Thejll told me. “We understand why it boils but cannot predict where the next bubble will be.”¶ There is also uncertainty about an apparent slowdown over the last decade in the rate of air temperature increase. While some critics claim that global warming has “stalled,” others point out that, when rising ocean temperatures are factored in, the Earth is actually gaining heat faster than previously anticipated.¶ “Temperatures measured over the short term are just one parameter,” said Dr Tim Barnett of the Scripps Institute of Oceanography in an interview. “There are far more critical things going on; the acidification of the ocean is happening a lot faster than anybody thought that it would, it’s sucking up more CO2, plankton, the basic food chain of the planet, are dying, it’s such a hugely important signal. Why aren’t people using that as a measure of what is going on?”¶ Barnett thinks that recent increases in volcanic activity, which spews smog-forming aerosols into the air that deflect solar radiation and cool the atmosphere, might help account for the temporary slowing of global temperature rise. But he says we shouldn’t let short term fluctuations cause us to lose sight of the big picture.¶ The dispute over temperatures underscores just how formidable the IPCC’s task of modeling the complexity of climate change is. Issued in three parts (the next two installments are due out in the spring), the full version of the IPCC will end up several times the length of Leo Tolstoy’s epic War and Peace. Yet every last word of the U.N. document needs to be signed off on by all of the nations on earth. ¶ “I do not know of any other area of any complexity and importance at all where there is unanimous agreement... and the statements so strong,” Mike MacCracken, Chief Scientist for Climate Change Programs, Climate Institute in Washington, D.C. told me in an email. “What IPCC has achieved is remarkable (and why it merited the Nobel Peace Prize granted in 2007).”¶ Not surprisingly, the IPCC’s conclusions tend to be “conservative by design,” Ken Caldeira, an atmospheric scientist with the Carnegie Institution’s Department of Global Ecology told me: “The IPCC is not supposed to represent the controversial forefront of climate science. It is supposed to represents what nearly all scientists agree on, and it does that quite effectively.”¶ Nevertheless, even these understated findings are inevitably controversial. Roger Pielke Jr., the Director of the Center for Science and Technology Policy Research at the University of Colorado, Boulder suggested a headline that focuses on the cat fight that today’s report is sure to revive: "Fresh Red Meat Offered Up in the Climate Debate, Activists and Skeptics Continue Fighting Over It." Pielke should know. A critic of Al Gore, who has called his own detractors "climate McCarthyists," Pielke has been a lightning rod for the political controversy which continues to swirl around the question of global warming, and what, if anything, we should do about it. ¶ The public’s skepticism of climate change took a dive after Hurricane Sandy. Fifty-four percent of Americans are now saying that the effects of global warming have already begun. But 41 percent surveyed in the same Gallup poll believe news about global warming is generally exaggerated, and there is a smaller but highly passionate minority that continues to believe the whole thing is a hoax. ¶ For most climate experts, however, the battle is long over — at least when it comes to the science. What remains in dispute is not whether climate change is happening, but how fast things are going to get worse.¶ There are some possibilities that are deliberately left out of the IPCC projections, because we simply don’t have enough data yet to model them. Jason Box, a visiting scholar at the Byrd Polar Research Center told me in an email interview that: “The scary elephant in the closet is terrestrial and oceanic methane release triggered by warming.” The IPCC projections don’t include the possibility — some scientists say likelihood — that huge quantities of methane (a greenhouse gas thirty times as potent as CO2) will eventually be released from thawing permafrost and undersea methane hydrate reserves. Box said that the threshhold “when humans lose control of potential management of the problem, may be sooner than expected.”¶ Box, whose work has been instrumental in documenting the rapid deterioration of the Greenland ice sheet, also believes that the latest IPCC predictions (of a maximum just under three foot ocean rise by the end of the century) may turn out to be wildly optimistic, if the Greenland ice sheet breaks up. “We are heading into uncharted territory” he said. “We are creating a different climate than the Earth has ever seen.” ¶ The head of the IPCC, Rajendra Pachauri, speaks for the scientific consensus when he says that time is fast running out to avoid the catastrophic collapse of the natural systems on which human life depends. What he recently told a group of climate scientist could be the most chilling headline of all for the U.N. report: ¶ "We have five minutes before midnight."

### 2NC Uniqueness

#### Clean Technology developing now – Tesla and Solar Power Prove

Lindenstein, 14 (3/26/14, Joshua L., Boulder County Buisness Report, “Clean tech closing in on energy storage,” <http://www.bcbr.com/article/20140325/NEWS/140329940>)

Jaffe was speaking at BizWest's CEO Roundtable on clean technology Tuesday sponsored by Boulder law firm Berg Hill Greenleaf & Ruscitti LLP and accounting firm EKS&H. Clean tech is a general term used to describe products, processes or services that reduce waste and require as few nonrenewable resources as possible.¶ Perhaps the most exciting topic in clean tech right now, he said, is electric carmaker Tesla's plans to build a "gigafactory" that will by 2020 produce more lithium ion batteries annually than were made globally in 2013. While the factory would have major implications for the auto industry, Jaffe said there are signs that the factory would also produce enough batteries for other uses that it could become a "seminal event" that shakes up energy storage.¶ Tesla is just the company to do it, he said. Elon Musk's company, after all, has already made all-electric cars cool, an idea scoffed at just a few years ago.¶ "The major car manufacturers' fundamental problem, business mistake, was they said (electric cars are great) for the greenies, a group they don't even know or understand to begin with," Jaffe said. "Instead they should have said this is a high performance car. … Tesla did that."¶ That unique way of thinking and problem-solving is also permeating other areas of clean tech, roundtable participants said. And it is key to clean tech's future success.¶ Solar power is making huge strides, they said, in part because of the way people are paying for it now. Not everyone has to front the large purchase cost of installing solar panels and then rake in the benefits over time, said Quayle Hodek, chief executive of Renewable Choice Energy in Boulder.¶ Power-purchase agreements are allowing businesses and individuals to sign contracts to purchase power from solar providers for 20 or 30 years, lowering their energy bills and at the same time locking in their energy rates without upfront costs. In particular, large companies like Google and Apple are seeing the value in locking in their rates with solar to avoid the volatility of fossil fuel prices.¶ What it's leading to is the overvaluation of some fossil fuel-based energy companies that have stranded assets like coal plants, Hodek and others said. New energy demand in the United States more and more being answered with renewable energy and less with coal.¶ "The cost of solar has fallen 50 percent in the last two years," Hodek said. "How do you compete with that? … Why in the world are we going to build more fossil fuel plants?"

#### Additional Investment for Clean Technology is coming now

Brown, et. al, 14 (Led by MIT engineers and Wall Street analysts, Trefis.com helps you understand how a company's products, that you touch, read, or hear about everyday, impact its stock price. Surprisingly, the founders of Trefis discovered that along with most other people they just did not understand even the seemingly familiar companies around them: Apple, Google, Coca Cola, Walmart, GE, Ford, Gap, and others.This might include you though you may have invested money in these companies, or may have been working with one of them for years as an employee, or have consulted with them as an expert for a long time. You can play with assumptions, or try scenarios, as-well-as ask questions to other users and experts. The platform uses extensive data to show in a single snapshot what drives the value of a company's business. Trefis is currently used by hundreds of thousands of investors, company employees, and business professionals.”GE Commits Additional $10 Billion To Clean Technology Development,” <http://www.forbes.com/sites/greatspeculations/2014/02/28/ge-commits-additional-10-billion-to-clean-technology-development/>)

Earlier this week, General Electric announced that it will invest additional $10 billion by 2020 for development of clean technologies which along side generating revenues will help reduce the impact on environment. Labelled ecomagination, the industrial conglomerate initiated this project involving development of clean technologies in 2005. At the time, it initially committed to invest $5 billion on these projects within five years. By 2010, the company decided to invest another $10 billion through 2015. With that second round of funding set to expire next year, the company in its latest round announced this additional $10 billion funding through 2020 for development of clean technologies.¶ The return on this investment in the ecomagination project has also been strong for GE. Since its launch in 2005, this project, according to the company’s own assessment, has generated around $160 billion in revenues with $300 million in savings realized through reduced freshwater usage and lower emissions. Overall, these investments in clean technology development now constitute a significant part of the company’s R&D budget, which totaled $4.7 billion last year. Here we highlight some of the key projects that GE will work on under its latest round of funding for ecomagination.¶

#### US has fastest growing Clean Tech market

Global Midwest Alliance, 14 (2014, Global Midwest Alliance, “Clean Technology Industry,” <http://www.globalmidwestalliance.org/PROGRAM_Clean_Technology.html>)

Did you know that the global clean tech market is worth some $5 trillion per year and is forecast to exceed $9 trillion by 2015? The U.S. is among the fastest growing international clean tech markets. Much of what is happening in renewable energy, sustainable manufacturing, clean technologies, environmental industries and green build is taking place in the Midwest. State governments are currently addressing long-term policy and regulatory challenges around the development and implementation of clean technologies. ¶ Clean technology development in the Midwest has a history with outcomes that include wind power development clusters, the greatest use of ‘green roofs’ in the world, a thriving green-build focus, the majority of biofuels producers globally and the world’s first private carbon exchange. The Midwest also hosts multiple universities, federal laboratories and research centers focused on the many clean-tech sub-sectors across industry. Collaborative efforts, partnerships and global outreach are all part of clean tech in the Midwest.¶ Due to the many challenges of conventional technologies, particularly in energy, which rely on limited natural resources and that may have adverse effects on the environment, clean technologies such as wind power, solar power, biomass, biofuels, water technologies, environmental and waste management, geothermal energy, natural gas technologies, recycling, energy efficiency and other alternatives are continuing to attract investment. ¶ In 2011, global clean technology venture investments saw the US leading in overall investment dollars, and China continuing to be seen as a major growth market for clean tech investments with a focus on renewable energy technologies. According to the published research, the top clean technology sectors in 2011 were fuel cell development, energy storage, solar, biofuels, demand management and transportation. Solar accounted for almost 35% of total clean technology investment, followed by demand management. Current estimates for the next five years include forecasts of $325 billion of global investment in solar, biofuels and wind alone.¶ The benefits for the Midwest in this global industry are broad - estimates expect the creation of 87,000 clean tech jobs and $40 billion in clean tech capital investment by the year 2030. These carry the added benefits of reductions in energy and technology costs for consumers in the years ahead.¶ The Alliance is providing a Clean Technology Industry Forum for meaningful interactions between key executives engaged in clean technologies including wind power, solar power, biomass, biofuels, water technologies, environmental and waste management, geothermal energy, natural gas technologies, recycling, energy efficiency and storage, and scientists engaged in scientific research with a view to creating new products and novel, effective solutions to improve the clean technology industry

#### Investment in renewable energy is high now

FAHEY 13 (06/26/13 Huffington Post “Renewable Energy Growth Is Rising Around The World, IEA Says” <http://www.huffingtonpost.com/2013/06/26/renewable-energy-growth_n_3504265.html>)

NEW YORK — Renewable energy is growing fast around the world and will edge out natural gas as the second biggest source of electricity, after coal, by 2016, according to a five-year outlook published Wednesday by the International Energy Agency.¶ Developing countries are building more wind, solar and hydro-electric power plants to meet rising power demand and combat local pollution problems. And the costs of renewables are falling below the cost of traditional power sources such as coal, natural gas and oil in some markets with high-priced power.¶ Renewable power, including hydropower, is the fastest-growing power generation sector and it is expected to increase by 40 percent in the next five years. By 2018 it will make up a quarter of the world's energy mix, according to the report, up from 20 percent in 2011.¶ Eighty percent of the renewable power generated in the world, however, is hydropower, a technology frowned upon by environmental groups and sustainability experts because it requires the construction of dams that can damage river ecosystems.¶ Non-hydroelectric sources such as wind, solar, geothermal and energy derived from plants are also expected to grow quickly, but they contribute a far smaller amount of energy to the global mix. These technologies will supply 8 percent of the world's energy by 2018, up from 4 percent in 2011 and 2 percent in 2006.¶ Still, renewable power is facing uncertain times as subsidies in developed countries wane. Investment in renewable projects fell in 2012, according to the IEA, an energy security and research organization based in Paris that serves 28 oil-importing countries, including the U.S.¶ In a report published in April, the IEA said the world's energy is no cleaner than it was 20 years ago because of rising reliance on coal-fired generation in China, India, and parts of Europe that are phasing out nuclear power and facing high natural gas prices.¶ "The rapid growth of renewables continues to beat expectations and is a bright spot in an otherwise bleak assessment of global progress toward a cleaner and more diversified energy mix," the report concludes.¶ The use of biofuels is expected to grow, though at a slower rate than renewable electricity, in part because companies haven't succeeded in developing technology that can squeeze fuels from plant waste or dedicated biofuel crops such as grasses at commercial scale. The vast majority of biofuel used today is alcohol – called ethanol – made from sugar cane or corn.¶ Biofuels use is projected to increase 25 percent by 2018 to 2.4 million barrels per day. By comparison, the world consumes 90 million barrels per day of petroleum.¶ Developing countries, led by China, will account for two-thirds of the global increase in renewable generation. Growth in Europe and the U.S. is expected to slow, though President Barack Obama outlined a sweeping plan Tuesday that would encourage renewed investment in renewable sources.¶ Renewable sources were used to generate 12 percent of the electricity consumed in the U.S. last year, according to the Energy Department. Hydroelectric plants supplied 7 percent of the country's power, and other renewables such as wind and solar supplied 5 percent.¶ Ethanol, mostly made from corn and blended with gasoline, was used to satisfy 10 percent of U.S. gasoline demand last year.¶ IEA Executive Director Maria van der Hoeven said in a statement that the biggest impediment to further renewable growth is changing energy policies that increase risk for investors. "Many renewables no longer require high economic incentives. But they do still need long-term policies that provide a predictable and reliable market and regulatory framework compatible with societal goals," she said.¶ The IEA estimates that worldwide subsides for fossil fuels are six times higher than incentives for renewables.

### 2NC Link – Consumer Behavior

#### Cheap natural gas shifts homeowners from renewable energy

Stepniak, 12 (1/6/12, Brittany S., Wealth Wire, “Cheap Natural Gas Threatens Renewable Energy,” http://www.wealthwire.com/news/energy/2473)

The renewable energy sector has grown rather quickly here in the United States – double digit growth for solar and wind energy –, but Recent competition from natural gas has homeowners shying away from solar panels. Although fossil fuel prices are sometimes volatile depending on a myriad of factors including resource availability and mining dilemmas, one fossil fuel has been on a steady price-decline. Natural gas has experienced so much of a price drop that the expensive solar panel markets are suffering. NPR ran a story yesterday regarding this “classic situation of supply and demand.” For homeowners, the demand for natural gas has not gone up because there are renewable energy sources now available. However, The natural gas supply has gone up with a lot of the Marcellus Shale and other similar projects seeing a lot of success around the U.S. Since 2005, the U.S. has seen a 30 percent increase in the amount of natural gas in our country. Experts say the new drilling techniques are largely responsible for this surge: fracking and horizontal drilling. With supply up and demand stagnant, prices have consequently fallen. For those who have already installed solar panels in their homes (before the economics changed), they are now questioning how wise that decision may or may not have been. In one case, Barbara Scott of Media, Pa had 21 solar panels installed last March. Government rebates and tax incentives included, Scott's family spent $21,000 for their new solar energy system. Ms. Scott anticipated that it would take about eight years to gain back the money lost in that investment. That prediction was rational at the time, but economics in the energy sector has changed. As of right now, Scott experts it will actually be a 17-year-long payback period, assuming the system doesn't need costly maintenance in that time-frame. Although Scott's is proud to have been the first family in her community to invest in the solar panels, she is hesitant about telling others to do the same. It's simply not as fiscally responsible as the natural gas alternative. Caperton [director of clean energy investment at the Center for American Progress] says what's more interesting is to think about the wind, solar and even nuclear plants that are not being built now because producing with cheaper natural gas is more attractive to investors. But natural gas prices could rise again quickly. If that happens, solar panels may seem like a good investment once again. Until then, it sounds like natural gas is staying strong in its role of holding our economy together by creating jobs and keeping energy costs low.

#### **Consumer spending drives governmental policy**

Vitez, 14 (2014, Osmond, V., Chron, “The Importance of Consumer Spending,” http://smallbusiness.chron.com/importance-consumer-spending-3882.html)

A national economy is a broad amalgamation of individual, business and government spending or investment. Governments typically pay close attention to economic factors to measure the strength of an economy. Consumers represent a major factor in economies. According to Henry Hazlitt, author of "Economics in One Lesson," U.S. consumers account for approximately 70 percent of the national economy. Spending is an important role of consumers. Free market economies rely on consumer demand to gauge the allocation and distribution of economic resources. Facts Consumer spending is an important economic factor because it usually coincides with the overall consumer confidence in a nation’s economy. High consumer confidence indicators usually relate to higher levels of consumer spending in the economic market. Consumer confidence provides governments and businesses with an analysis on consumer perception. In the United States, The Conference Board measures consumer confidence by conducting a survey of 5,000 households. Consumers respond to a few questions from which The Conference Board calculates consumer confidence.

### 2NC Link – General

#### **Shale gas will crowd out renewable energy as it is cheaper and abundant**

Inman 12 (1/17/12, Mason I., National Geographic News, “Shale gas has transformed the U.S. energy landscape in the past several years—but it may crowd out renewable energy and other ways of cutting greenhouse gas (GHG) emissions, a new study warns,” http://news.nationalgeographic.com/news/energy/2012/01/120117-shale-gas-boom-impact-on-renewables/)

Shale gas has transformed the U.S. energy landscape in the past several years—but it may crowd out renewable energy and other ways of cutting greenhouse gas (GHG) emissions, a new study warns.¶ Share¶ Share on emailEmail¶ More »¶ A team of researchers at Massachusetts Institute of Technology used economic modeling to show that new abundant natural gas is likely to have a far more complex impact on the energy scene than is generally assumed. If climate policy continues to play out in the United States with a relatively weak set of measures to control emissions, the new gas source will lead to lower gas and electricity prices, and total energy use will be higher in 2050.¶ Absent the shale supply, the United States could have expected to see GHG emissions 2 percent below 2005 levels by 2050 under this relatively weak policy. But the lower gas prices under the current shale gas outlook will stimulate economic growth, leading GHG emissions to increase by 13 percent over 2005. And the shale gas will retard the growth of renewable energy's share of electricity, and push off the development of carbon capture and storage technology, needed to meet more ambitious policy targets, by as long as two decades.¶

#### Cheap natural gas undercuts renewable development

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The United States has won the lottery on natural gas. According to the most recent estimates by the Energy Information Administration, the U.S. has some 2,214 trillion cubic feet cubic feet of technically recoverable natural gas — enough to satisfy all of our natural gas demands for the next century at current consumption levels. The extraction of shale gas, enabled by technological advances such as hydrofracturing and horizontal drilling, has led the way in creating this largely unforeseen cornucopia. Domestic natural gas is now a cheaper fuel for electricity generation than coal — long our go-to fuel for power around the clock — and emits roughly half the greenhouse gas emissions. It appears that our energy problems are over — or are they? A full-throttle shift to a gas-dominated electricity system, which now appears to be the ordained path forward in many parts of the country, will flash through our newfound abundance more quickly than we realize, and will not ultimately stave off catastrophic climate change, which by any reasonable measure of sanity is still the defining challenge of the 21st The rose of abundant gas is not without thorns, including the risk of price increases. century — cheap gas or not. Within a decade or less, we could be facing high natural gas costs again, plus the added burden of a planet in an ever-deepening ecological crisis. Amid the din of enthusiasm surrounding the rush to natural gas, we run the risk of losing the real prize: a U.S. energy future consistent with our economic, environmental, and lifestyle aspirations. Wise use of natural gas, in conjunction with policies to support continued growth in renewable energy, can serve as a catalyst to quicken the transition to a sustainable energy system. The recent and staggering abundance of natural gas is, ostensibly, a very good thing. Provided that current low natural gas prices persist and that resource estimates hold true, natural gas combined cycle power plants will gradually replace our nation’s aging coal-fired generation fleet. Our electricity will become cleaner, cheaper, and more efficient, and the superior ability of natural gas combined cycle turbines to ramp up quickly will allow easier grid integration of variable energy sources like wind and solar power. This shift is already happening. Cancellations of coal deliveries and advance coal contracts have become common as utilities switch to natural gas. The U.S. Environmental Protection Agency (EPA) recently promulgated carbon dioxide emissions thresholds for new power plants that exactly match specs for natural gas combined cycle plants. The agency went so far as to opine that the rule actually wasn’t even necessary since such plants “will be the predominant choice for new fossil fuel-fired generation even absent this rule.” A gas-drilling rig explores the Marcellus Shale in southwestern Pennsylvania. But the rose of abundant natural gas is not without thorns. One such thorn is the risk of price increases. James Rogers, the CEO of Duke Energy, recently quipped that to Benjamin Franklin’s observation that only death and taxes are certain in life, “I would add the price volatility of natural gas.” Creating a gas-dependent generation fleet exposes us to future price spikes and hitches our fuel security to large uncertainties in the amount of domestic gas that is ultimately recoverable. A full century’s worth of a relatively clean and potentially cheap fuel at our current rate of consumption is obviously an extraordinary thing. Equally obvious is that our current rate of consumption will not remain flat for the next 100 years. If anything, natural gas will likely play a far greater role in our energy mix than it currently does, whether by displacing coal-fired generation, utilization in natural gas vehicles, increased use in manufacturing, or by outcompeting renewables as the cheapest source of power. Another set of thorns comes in the form of adverse environmental and social impacts from natural gas production. Despite recent advancements in impact mitigation such as faster drilling, smaller and fewer well-pad footprints, and EPA methane capture requirements that go into effect in 2015, there remain serious concerns regarding the potential for shale gas production to contaminate sources of ground and drinking water, induce seismic events, and harm local air quality. Conflicts have already arisen between industry and the communities that bear the burdens of gas development, and they will likely increase in number as development continues: The Energy Information Administration estimates that bringing most of the U.S. shale gas and shale oil resources into production will require more than 630,000 new wells, in addition to the approximately 487,627 natural gas wells producing in 2010. Communities that have never seen a drilling rig will be inundated with heavy truck traffic, blanketed with acrid exhaust from trucks and generators, and exposed to a surfeit of noise, lights, and dust from drilling and related activities. When communities face up to these realities, as is already occurring, it may become significantly more difficult and expensive for developers to obtain the so-called “social license to operate” in populated areas. This is not to say that community opposition will stop gas development entirely, but rather that it is wickedly hard to predict just how much of the gas resource will be socially developable, and how expensive it will become for developers to comply with tighter regulations that are likely to come with community opposition. The natural gas boom also presents the prospect of imminent harm to the deployment of renewable energy, and dire environmental consequences that will follow from a failure to cease adding greenhouse gases to the atmosphere. The growing swell toward a utility sector dominated by The natural gas boom presents the prospect of imminent harm to the deployment of renewable energy. Natural gas has already resulted in collateral damage throughout the renewables industry. Wind, for example, had previously been capable of competing with natural gas generation on a cost basis, thanks to advances in technology and a federal production tax credit that seems poised to expire at the end of this year. Installation of new renewable energy facilities has now all but dried up, unable to compete on a grid now flooded with a low-cost, high-energy fuel that can provide power on demand. What little support there is for renewables is mostly found in state renewable portfolio standards — a policy subsidy that many states appear to be rethinking in light of hard economic times and cheap natural gas.

#### **Shale Gas Development causes a decrease in renewable energy use due to lower prices**

European Renewable Energy Council, 13 (6/13, EREC., EREC factsheet, “Shale Gas and its impact on Renewable Energy Sources,” http://www.erec.org/fileadmin/erec\_docs/Documents/EREC\_Factsheet\_on\_Affects\_of\_Shale\_Gas\_on\_RES.pdf)

Private investment: Most analyses emphasize the threat that shale gas poses to the deployment of renewable energy sources, as cheap natural gas provides an alternative source of energy at a lower price, and as such potentially diverts investment away from renewables. This is the line followed by the International Energy Agency (IEA) in its report on the ‘Golden Age of Gas’. A report by the Citibank however states that additional gas-fired power – including from shale gas – may, in the case of variable renewable energy technologies, be beneficial from an overall system perspective21. A Bloomberg New Energy Finance report observes the effects of shale gas on the US renewable energy market leading to decreased RES investments in the US in 2012 compared to the year before22. Similarly, report by MIT looking at US energy scenarios found that shale gas development suppresses the development of the renewables sector23. Public investment:

### 2NC Link – RPS

#### Cheap natural gas causes a shift from renewables – adjust states’ RPS decisions

Martin 13**,** (4/23/13, Christopher M., Bloomberg, “U.S. States Turns Against Renewable Energy as Gas Plunges,” <http://www.bloomberg.com/news/2013-04-23/u-s-states-turn-against-renewable-energy-as-gas-plunges.html>)

More than half the U.S. states with laws requiring utilities to buy renewable energy are considering ways to pare back those mandates after a plunge in natural gas prices brought on by technology that boosted supply. Sixteen of the 29 states with renewable portfolio standards are considering legislation that would reduce the need for wind and solar power, according to researchers backed by the U.S. Energy Department. North Carolina lawmakers may be among the first to move, followed by Colorado and Connecticut. The efforts could benefit U.S. utilities such as Duke Energy Corp (DUK). and PG&E Corp (PCG). as well as Exxon Mobil Corp (XOM)., the biggest U.S. oil producer, and Peabody Energy Corp (BTU)., the largest U.S. coal mining company. Those companies contributed to at least one of the lobby groups pushing the change, according to the Center for Media and Democracy, a Madison, Wisconsin-based non-profit group. It would hurt wind turbine maker Vestas Wind Systems A/S (VWS) and First Solar Inc (FSLR)., which develops solar farms. “We’re opposed to these mandates, and 2013 will be the most active year ever in terms of efforts to repeal them,” said Todd Wynn, task force director for energy of the American Legislative Exchange Council, or Alec, a lobby group pushing for the change. “Natural gas is a clean fuel, and regulators and policy makers are seeing how it’s much more affordable than renewable energy.” Conference Discussion President Jack Gerard of the American Petroleum Institute, a trade group for the oil and gas industry, along with the former governors of Colorado and New Mexico will speak about the issue today in New York at a conference hosted by Bloomberg New Energy Finance.Hydraulic-fracturing technology opened aging reservoirs for natural gas drilling, driving prices down about 72 percent from their record 2005 high. That’s making more expensive wind and solar power projects harder for utility regulators to justify, according to Alec and its allies, which include the Heritage Foundation in Washington. “The shale revolutions are not just having ramifications politically and economically in the U.S. but also around the world,” said Michael Liebreich, chief executive officer of Bloomberg New Energy Finance. “In 17 years, not that far away, we could reach peak energy use. This is not generally accepted.”

### 2NC Impact – Energy Independence

#### Clean energy is key to energy independence

Union of Concerned Scientists, 10 (4/1/10, Union of Concerned Scientists, “Clean Technology Brings Significal Global Security Benefits,” <http://www.ucsusa.org/global_warming/solutions/reduce-emissions/clean-technology-security-benefits.html>)

Lowering heat-trapping emissions from the transportation sector—which currently accounts for about 30 percent of U.S. emissions5—is the most important step we can take to reduce our nation’s reliance on oil (including the portion that comes from unstable regimes around the world). Investing in cleaner vehicles, low-carbon fuels, and a more efficient transportation system, plus efficiency improvements that reduce oil use in industry and home heating, could cut U.S. petroleum consumption 6 million barrels per day by 2030 compared with 2005—as much as we now import from the Organization of the Petroleum Exporting Countries (OPEC).6¶ An analysis by the U.S. Energy Information Administration shows that ACES would lower overall use of oil and other petroleum products about 1.2 million barrels per day by 2030. That would save the United States approximately $250 billion∗ in oil imports during that time,7 and help shield the U.S. economy from the effects of sudden changes in oil supply and prices. The five significant spikes in oil prices of the past 40 years, for example, were all followed by an economic recession.8¶ Given that the United States currently controls only 1.6 percent of the world’s proven oil reserves,9 and that U.S. domestic crude oil production has declined 50 percent since 1970,10 we simply do not have enough new oil recoverable from domestic sources at a reasonable cost to substantially displace imports or influence the world price for oil. As such, our continued dependence on oil will keep the United States reliant on foreign sources of oil, which in turn will keep us embroiled in the politics of the Middle East and other volatile regions.¶ The alternative is clear. More efficient transportation choices, a diversified mix of clean,¶ ∗ Net present value in 2007 dollars, based on a discount rate of 7 percent.¶ ￼￼￼￼￼￼￼￼PHOTOS: (top to bottom) USAID, NRC/PPT Susquehanna, U.S. Army, iStockphoto.com, NREL.¶ renewable, homegrown energy, and smart growth policies that provide more transportation options can finally give U.S. consumers protection from oil market volatility, while lessening the burden we place on our military to ensure a stable oil supply.¶ Greater Energy Security¶ Our energy and power infrastructure is currently exposed to a number of safety and security risks. Large coal and nuclear power plants connected to long-distance transmission lines, for example, are vulnerable to disruption from sabotage or severe weather. Nuclear reactor containment buildings were not built to withstand the impact of a commercial jet, and a 9/11-style attack (or serious accident) could kill tens of thousands and contaminate an area the size of Pennsylvania. Similarly, a rupture in the hold of a tanker containing liquefied natural gas could result in an explosion that sends flames over several miles.11 Climate change- related effects such as severe hurricanes and the prolonged thawing of permafrost also threaten our oil and natural gas infrastructure off our coasts and in Alaska, respectively.12¶ We can significantly reduce these vulnerabilities and risks by using energy more efficiently and making the transition to a more distributed energy system that uses locally available renewable energy resources and more modular technologies such as solar water heaters, photovoltaic panels, wind turbines, and biomass-fueled electricity generators. This shift would also reduce both our dependence on imports of liquefied natural gas, which frequently come from the same unstable parts of the world that produce much of our oil, and our reliance on electricity from coal-fired power¶ plants, which currently account for about one-third of U.S. carbon dioxide emissions.¶

#### Oil dependence undermines strategic US leadership

Electrification Coalition, ELECTRIFICATION ROADMAP: REVOLUTIONIZING TRANSPORTATION AND ACHIEVING ENERGY SECURITY, 11—09, p. 30.

**The importance of oil** in the U.S. economy **has given it a place of prominence in foreign and military policy.** In particular, **two key issues related to oil affect national security. First, the vulnerability of global oil supply lines and infrastructure has driven the United States to accept the burden of securing the world’s oil supply. Second, the importance of large individual oil producers constrains U.S. foreign policy options when dealing with problems in these nations. A crippling disruption to global oil supplies ranks among the most immediate threats to the United States today. A prolonged interruption** due to war in the Middle East or the closure of a key oil transit route **would lead to severe economic dislocation. U.S. leaders have recognized this for decades, and have made it** a matter of **stated policy that the United States will protect the free flow of oil with military force. Still, policy alone has consistently fallen short of complete deterrence, and the risk of oil supply interruptions has persisted for nearly 40 years.** To mitigate this risk, U.S. armed forces expend enormous resources protecting chronically vulnerable infrastructure in hostile corners of the globe and patrolling oil transit routes. This engagement benefits all nations, but comes primarily at the expense of the American military and ultimately the American taxpayer. A 2009 study by the RAND Corporation placed the ongoing cost of this burden at between $67.5 billion and $83 billion annually, plus an additional $8 billion in military operations. 33 In proportional terms, these costs suggest that **between 12 and 15 percent of the current defense budget is devoted to guaranteeing the free flow of oil. Foreign policy constraints related to oil dependence are** less quantifiable, but no less **damaging. Whether dealing with uranium enrichment in Iran, a hostile regime in Venezuela, or an increasingly assertive Russia, American diplomacy is distorted by our need to minimize disruptions to the flow of oil. Perhaps more frustrating, the importance of oil to the broader global economy has made it nearly impossible for the United States to build international consensus on a wide range of foreign policy and humanitarian issues.**

#### Failed leadership causes **extinction**—no alternative to hegemony

Brzezinski 12 Zbigniew K. Brzezinski (CSIS counselor and trustee and cochairs the CSIS Advisory Board, holds honorary degrees from Georgetown University, Williams College, Fordham University, College of the Holy Cross, Alliance College, the Catholic University of Lublin, Warsaw University, and Vilnius University. He is the recipient of numerous honors and awards) February 2012 “After America” http://www.foreignpolicy.com/articles/2012/01/03/after\_america?page=0,0

For **if America falters**, the world is unlikely to be dominated by a single preeminent successor -- not even China. International uncertainty, **increased tension** among global competitors, **and** even outright **chaos** **would be** far more **likely** outcomes. While a sudden, massive crisis of the American system -- for instance, another financial crisis -- would produce a fast-moving chain reaction leading to global political and economic disorder**, a steady drift by America into** increasingly pervasive **decay** or endlessly widening warfare with Islam **would be unlikely to produce**, even by 2025, **an effective global successor**. No single power will be ready by then to exercise the role that the world, upon the fall of the Soviet Union in 1991, expected the United States to play: the leader of a new, globally cooperative world order. **More probable would be a protracted phase of rather inconclusive realignments of both global and regional power, with no** grand **winners and many more losers, in a setting of international uncertainty and even of potentially fatal risks to global well-being**. Rather than a world where dreams of democracy flourish, a Hobbesian world of enhanced national security based on varying fusions of authoritarianism, nationalism, and religion could ensue. RELATED 8 Geopolitically Endangered Species The leaders of the world's second-rank powers, among them **India, Japan, Russia, and** some **European countries, are already assessing the potential impact of U.S. decline** on their respective national interests. The Japanese, fearful of an assertive China dominating the Asian mainland, may be thinking of closer links with Europe. Leaders in India and Japan may be considering closer political and even military cooperation in case America falters and China rises. **Russia**, while perhaps engaging in wishful thinking (even schadenfreude) about America's uncertain prospects, **will almost certainly have its eye on the independent states of the former Soviet Union. Europe**, not yet cohesive, **would likely be pulled in several directions:** Germany and Italy toward Russia because of commercial interests, France and insecure Central Europe in favor of a politically tighter European Union, and Britain toward manipulating a balance within the EU while preserving its special relationship with a declining United States. **Others may move more rapidly to carve out their own regional spheres:** Turkey in the area of the old Ottoman Empire, Brazil in the Southern Hemisphere, and so forth. **None of these countries, however, will have the requisite combination of economic, financial, technological, and military power even to consider inheriting America's leading role.** China, invariably mentioned as America's prospective successor, has an impressive imperial lineage and a strategic tradition of carefully calibrated patience, both of which have been critical to its overwhelmingly successful, several-thousand-year-long history. China thus prudently accepts the existing international system, even if it does not view the prevailing hierarchy as permanent. It recognizes that success depends not on the system's dramatic collapse but on its evolution toward a gradual redistribution of power. Moreover, the basic reality is that **China is not yet ready to assume in full America's role in the world**. Beijing's leaders themselves have repeatedly emphasized that on every important measure of development, wealth, and power, **China will still be a modernizing and developing** state **several decades from now, significantly behind not only the United States but also Europe and Japan in the major per capita indices of modernity and national power**. Accordingly, **Chinese leaders have been restrained in laying any overt claims to global leadership.** At some stage, **however, a more assertive Chinese nationalism could arise** and damage China's international interests**. A swaggering, nationalistic Beijing would unintentionally mobilize a powerful regional coalition against itself.** None of China's key neighbors -- India, Japan, and Russia -- is ready to acknowledge China's entitlement to America's place on the global totem pole. **They might even seek support from a waning America to offset an overly assertive China. The resulting regional scramble could become intense, especially given the similar nationalistic tendencies among China's neighbors. A phase of acute international tension in Asia could ensue. Asia** of the 21st century **could then begin to resemble Europe of the 20th century -- violent and bloodthirsty.** At the same time, **the security of a number of weaker states** located geographically next to major regional powers also **depends on the international status quo reinforced by America's global preeminence** -- and would be made significantly more vulnerable in proportion to America's decline. The states in that exposed position -- **including Georgia, Taiwan, South Korea, Belarus, Ukraine, Afghanistan, Pakistan, Israel, and the greater Middle East** -- are today's geopolitical equivalents of nature's most endangered species. **Their fates are closely tied to the nature of the international environment left behind by a waning America, be it ordered and restrained or, much more likely, self-serving and expansionist. A faltering United States could also find its strategic partnership with Mexico in jeopardy.** America's economic resilience and political stability have so far mitigated many of the challenges posed by such sensitive neighborhood issues as economic dependence, immigration, and the narcotics trade. **A decline in American power, however, would likely undermine the health and good judgment of the U.S. economic and political systems. A waning United States would likely be more nationalistic, more defensive about its national identity, more paranoid about its homeland security, and less willing to sacrifice resources for the sake of others' development**. The worsening of relations between a declining America and an internally troubled Mexico could even give rise to a particularly ominous phenomenon: the emergence, as a major issue in nationalistically aroused Mexican politics, of territorial claims justified by history and ignited by cross-border incidents. **Another consequence of American decline could be a corrosion of the generally cooperative management of the global commons** -- **shared interests such as sea lanes, space, cyberspace, and the environment, whose protection is imperative to the long-term growth of the global economy and the continuation of basic geopolitical stability.** In almost every case, **the potential absence of a constructive and influential U.S. role would fatally undermine the essential communality of the global commons because the superiority and ubiquity of American power creates order where there would normally be conflict**. None of this will necessarily come to pass. Nor is the concern that America's decline would generate global insecurity, endanger some vulnerable states, and produce a more troubled North American neighborhood an argument for U.S. global supremacy. In fact, the strategic complexities of the world in the 21st century make such supremacy unattainable. But those dreaming today of America's collapse would probably come to regret it. And as **the world after America would be increasingly complicated and chaotic,** it is imperative that the United States pursue a new, timely strategic vision for its foreign policy -- or start bracing itself for a dangerous slide into global turmoil.

### 2NC Impact – Economy

#### Clean tech increases the GDP and creates jobs

Wang, 11 (6/28/11, Ucilia W., Forbes, “Google Does Math To Show Clean Tech’s Imapct on The Economy,” <http://www.forbes.com/sites/uciliawang/2011/06/28/google-does-math-to-show-cleantechs-impact-on-the-economy/>)

Google, which has made big investments in wind, solar and electric car technologies, has never been shy about using its brand to promote stronger clean tech policies. The latest effort comes in the form of a report and an interactive website released Tuesday to show that enough clean tech innovations can add 1.1 million jobs and $158 billion to the country’s gross domestic product per hear while cutting energy costs by $942 per household annually all by 2030.¶ If innovations are paired with stronger energy policies, the country will add $244 billion to the GDP and nearly 2 million jobs while saving home energy costs by $995 per household, Google says. The GDP growth wouldn’t be much different without better policies.¶ Google uses a calculation tool from McKinsey and Co. – along with a wide range of government data and its own assumptions – to show the results of technology breakthroughs and more aggressive policies versus the status quo. Status quo takes into consideration current state and federal renewable energy policies and existing forecasts for energy costs by the federal government and by Google’s own calculations. The search giant uses all these variables to figure out clean tech’s impact on clean power generation, electric car market, energy storage and natural gas development.

#### Economic decline causes global nuclear war

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With the global financial system in serious trouble, is America's geostrategic dominance likely to diminish? If so, what would that mean? One immediate implication of the crisis that began on Wall Street and spread across the world is that the primary instruments of U.S. foreign policy will be crimped. The next president will face an entirely new and adverse fiscal position. Estimates of this year's federal budget deficit already show that it has jumped $237 billion from last year, to $407 billion. With families and businesses hurting, there will be calls for various and expensive domestic relief programs. In the face of this onrushing river of red ink, both Barack Obama and John McCain have been reluctant to lay out what portions of their programmatic wish list they might defer or delete. Only Joe Biden has suggested a possible reduction -- foreign aid. This would be one of the few popular cuts, but in budgetary terms it is a mere grain of sand. Still, Sen. Biden's comment hints at where we may be headed: toward a major reduction in America's world role, and perhaps even a new era of financially-induced isolationism. Pressures to cut defense spending, and to dodge the cost of waging two wars, already intense before this crisis, are likely to mount. Despite the success of the surge, the war in Iraq remains deeply unpopular. Precipitous withdrawal -- attractive to a sizable swath of the electorate before the financial implosion -- might well become even more popular with annual war bills running in the hundreds of billions. Protectionist sentiments are sure to grow stronger as jobs disappear in the coming slowdown. Even before our current woes, calls to save jobs by restricting imports had begun to gather support among many Democrats and some Republicans. In a prolonged recession, gale-force winds of protectionism will blow. Then there are the dolorous consequences of a potential collapse of the world's financial architecture. For decades now, Americans have enjoyed the advantages of being at the center of that system. The worldwide use of the dollar, and the stability of our economy, among other things, made it easier for us to run huge budget deficits, as we counted on foreigners to pick up the tab by buying dollar-denominated assets as a safe haven. Will this be possible in the future? Meanwhile, traditional foreign-policy challenges are multiplying. The threat from al Qaeda and Islamic terrorist affiliates has not been extinguished. Iran and North Korea are continuing on their bellicose paths, while Pakistan and Afghanistan are progressing smartly down the road to chaos. Russia's new militancy and China's seemingly relentless rise also give cause for concern. If America now tries to pull back from the world stage, it will leave a dangerous power vacuum. The stabilizing effects of our presence in Asia, our continuing commitment to Europe, and our position as defender of last resort for Middle East energy sources and supply lines could all be placed at risk. In such a scenario there are shades of the 1930s, when global trade and finance ground nearly to a halt, the peaceful democracies failed to cooperate, and aggressive powers led by the remorseless fanatics who rose up on the crest of economic disaster exploited their divisions. Today we run the risk that **rogue states may choose to become ever more reckless with their nuclear toys**, just at our moment of maximum vulnerability. The aftershocks of the financial crisis will almost certainly rock our principal strategic competitors even harder than they will rock us. The dramatic free fall of the Russian stock market has demonstrated the fragility of a state whose economic performance hinges on high oil prices, now driven down by the global slowdown. China is perhaps even more fragile, its economic growth depending heavily on foreign investment and access to foreign markets. Both will now be constricted, inflicting economic pain and perhaps even sparking unrest in a country where political legitimacy rests on progress in the long march to prosperity. None of this is good news if the authoritarian leaders of these countries seek to divert attention from internal travails with external adventures. As for our democratic friends, the present crisis comes when many European nations are struggling to deal with decades of anemic growth, sclerotic governance and an impending demographic crisis. Despite its past dynamism, Japan faces similar challenges. India is still in the early stages of its emergence as a world economic and geopolitical power. What does this all mean? There is no substitute for America on the world stage. The choice we have before us is between the potentially disastrous effects of disengagement and the stiff price tag of continued American leadership.

### 2NC Impact – Turns Case

#### Clean tech has the power to explore the ocean and more effectively fill the requirements of the aff.

The Guardian ‘13(“Cleantech 100 case study: Liquid Robotics” by Jim Witkin, journalist, Wednesday 9 October 2013 19.01 EDT, from the Gaurdian, http://www.theguardian.com/sustainable-business/liquid-robotics-global-cleantech-100-case-study)

Oceans cover three quarters of the earth's surface yet remain mostly unexplored. Vast distances and harsh conditions make manned ocean exploration expensive and often hazardous. So why not get robots to do the job? "The robot doesn't get sea sick, it doesn't slip on the deck and hurt itself, it doesn't get bored, and it doesn't run out of fuel," says Bill Vass, chief executive at Liquid Robotics, developer of the Wave Glider, an unmanned robotic vessel designed to monitor, observe and measure the world's oceans. Founded in 2007, with offices in California and Hawaii, the company's technology grew out of efforts to capture the songs of migrating humpback whales. Today, researchers are using the Wave Glider to study ocean ecosystems and habitats. Commercial customers like oil and gas companies use it to survey the ocean floor and detect seepage from undersea wells. And government agencies use it for coastal and border security. The Wave Glider consists of two parts. A float resembling a big surfboard stays at the surface, moving up and down with the waves. It holds the computers and various marine sensors. It connects by a seven-metre tether to a submerged glider with wings. The up-and-down motion between the float and glider produces energy that propels the craft forward. Solar panels on the float generate power for computing and navigation and for transmitting data back to shore in real time. The craft's zero footprint is important to customers, especially scientific researchers, says Vass. "Using only renewable energy, we don't damage the environment that we interact with. We are completely silent, have no carbon footprint, and no emissions of any type." The craft has proven itself durable. About 200 Wave Gliders have been deployed, logging more than 300,000 nautical miles. Not one has been lost at sea, according to the company, even while enduring Category 3 hurricanes and Category 4 cyclones. A typical mission can last from two to six months and average speeds for the craft are two to three knots. The Wave Glider navigates by autopilot, with its route programmed prior to a mission. But onboard sensors monitor its surroundings so it can find its way around obstacles. Human pilots at Liquid Robotics can also steer the craft and change its route at any time. Customers have the option to buy or lease the Wave Glider. They can also hire Liquid Robotics to perform the data collection as part of data-as-a-service scheme. The company is growing fast and now has some 120 employees, including Silicon Valley luminaries such as James Gosling, the inventor of the Java programming language, who now serves as the company's chief software architect. As for the future, Vass notes, "There are a lot of things we can do that alleviate the need for a ship." He estimates that using a ship can be up to 10 times more costly than a Wave Glider for the same mission. "Ships are only getting more expensive," says Vass, "so we see what we are doing as the beginning of a very big market."

### AT: Other Countries Prevent Solvency

#### Clean tech is developing globally

Efstathiou, 8 (6/1/8, Jim Efstathiou Jr., Bloomberg, “Global Clean-Tech Energy Investment Rose 60% in 2007,” <http://www.bloomberg.com/apps/news?pid=newsarchive&sid=apeyv.EIQQv4&refer=australia>)

Three countries, India, China and Brazil, saw total investment of $26 billion for renewable energy sources, 14 times the level in 2004, Liebreich said.¶ U.S. investors are ``gearing up for a major shift in political attitude'' toward clean energy, according to the report. The next U.S. president ``is expected to make renewable energy and energy efficiency a political priority.''¶ Governments are negotiating a global agreement that would replace the 1997 Kyoto Protocol, which required developed nations to reduce emissions of greenhouse gases blamed for global warming. The Kyoto treaty, which the U.S. rejected, runs out in 2012. The new treaty is to be completed in Copenhagen next year.¶ ``With world temperatures and fossil fuel prices climbing higher, it is increasingly obvious to the public and investors alike that the transition to a low-carbon society is both a global imperative and an inevitability,'' Steiner said. ``The findings should empower governments to reach a deep and meaningful new agreement.''

### AT: Other Countries Solve

#### US leadership is key to worldwide development of clean energy

Brook 2010 (Clare Brook for the Guardian Professional Network, Clare Brook is co-founder of WHEB Asset Management and fund manager of the IM WHEB Sustainability Fund, Monday 29 November 2010 07.45 EST, theguardian.com, http://www.theguardian.com/sustainable-business/blog/clean-technology-solutions-global-warming)

Given all we know about the threat of climate change, and the available solutions, why is the world moving so slowly towards a clean global economy? I recently attended the Jefferies Cleantech conference. Presenting at this two-day event were 60 companies, ranging from early stage small private firms to large, well established multinationals. All had technologies which, if put together and applied widely in the world, could solve most of the world's environmental problems and allow us to attain the 80% reduction in CO2 emissions deemed necessary to ward off the most cataclysmic effects of climate change. Represented were wave energy, solar power, second generation biofuels, geothermal steam, wind power, batteries for electric vehicles, companies rolling out the smart grid and many more technologies at the cutting edge of clean technology solutions. But easily the most well attended meeting at the conference was the talk delivered by the minister of state for climate change, Greg Barker. That high attendance is indicative of the fact that without government support, in the form of legislation and subsidies, most of the companies at the conference are in for a very difficult time indeed. And predicting what this most recently elected government intends to do is every bit as complex as predicting when the wind will blow on your wind farm or when the sun will shine on your solar panel. Harder, in fact. The speech itself revealed nothing we didn't already know, but in the Q&A afterwards, someone asked him whether the government intends to alter the feed-in-tarrifs for solar installations in the UK. Mr Barker confirmed what other ministers had been hinting at earlier in the week; that while the government intends to keep the attractive feed-in-tarrifs introduced for roof-top photo-voltaics (the generous tarrifs introduced in the last days of the Labour government on 1 April this year), they may withdraw tariffs for farm-scale installations as these 'soak up all the subsidy'. This is not such good news if you're a company attempting to build a business model around larger scale solar installations in the south of England. It is also not good news for the UK's hopes of achieving our targets of 20% of our energy coming from renewables by 2020, because much of this contribution must be delivered commercially, rather than just by individuals. In fairness to Barker and the coalition government, at least they are only proposing to cut future commercial scale feed-in-tarrifs from 2012. Whereas the Spanish government has spent a lot of time over the last year discussing whether they should retroactively cut feed-in-tarrifs. They have just decided against cuts, but the damage has been done, sending tremors around the solar market and contributing to heavy share price falls in module manufacturers, equipment makers and developers. The Spanish government must surely be aware that as soon as they start to waver over legislation, shockwaves are felt in what is a fragile, young industry. Developers, who need, typically, at least 10 years' visibility in order to make their projects viable, will run faster than water through a small-scale hydro turbine if they sense regulatory uncertainty. In Germany, which currently accounts for around three-quarters of all installed photo-voltaics in the world, the government has gone through convulsions over the past two years, with every tariff renewal presaged by threats of very large reductions, and now the apparently real danger of a cap on overall installations. Over this same period, the average forward price to earnings multiple of the solar power companies has dropped dramatically, reflecting an industry riven by uncertainty. Finally, let's not forget the United States. When Barak Obama came to power he pledged: 'I will set as a clear goal as President: in 10 years we will finally end our dependence on oil from the Middle East.' He also spoke of doubling America's renewable energy generation in three years. Yet such strident statements were not reiterated by the US delegation in Copenhagen last December and the mid-term swing to the Republicans has effectively quashed any hope of the Waxman Markey bill (a proposal to adopt a cap and trade system to significantly reduce greenhouse gas emissions) from being adopted by Congress. The upshot is that the most powerful economy in the world (for the time being) is wavering in its commitment to adoption of clean technologies so that ambitious companies in this field are having to turn to Asia or Europe for better prospects of growth. This time last year, we were all eagerly anticipating what might be achieved at Copenhagen. A year later, we are all older and wiser, expecting very little from Cancun and wary of the vacillations of governments. In order to attract sustainable levels of investment into emerging clean technology industries, and to do so at the lowest cost, there needs to be clarity down to quite a detailed level in terms of the regulatory framework. If that were set in the context of a clear energy picture - which was agreed across political parties - to roll out the smart grid and adopt renewables over the next few decades, innovation and investment in these sectors would flourish. Whereas at the moment, companies and investors are faced with a muddled picture at best from most governments. This is arguably the biggest cloud blocking clean technology impetus.

## Renewable Tradeoff DA Answers

### Non-Unique

#### Low natural gas prices already doomed clean tech

Eilperin 12(Juliet, “The clean tech meltdown,” 09 FEBRUARY 12 from *Wired* magazine, uliet Eilperin is the national environmental reporter for The Washington Post and the author of Demon Fish: Travels Through the Hidden World of Sharks, http://www.wired.co.uk/magazine/archive/2012/03/features/the-clean-tech-meltdown)

John Doerr was crying. The billionaire venture capitalist had come to the end of his now-famous March 8, 2007, TED talk on climate change and renewable energy, and his emotions were getting the better of him. Doerr had begun by describing how his teenage daughter told him that it was up to his generation to fix global warming, since they had caused it. Doerr, who made his fortune investing early in companies that became some of Silicon Valley's biggest names, exhorted the audience to band together and transform the nation's energy supply. "I really, really hope we multiply all of our energy, all of our talent, and all of our influence to solve this problem," he said, fighting back tears. "Because if we do, I can look forward to the conversation I'm going to have with my daughter in 20 years." As usual, Doerr's timing was perfect. Just weeks earlier, Al Gore's An Inconvenient Truth had won an Oscar for best documentary. (Gore is now a partner in Doerr's green-tech team at the VC firm Kleiner Perkins Caufield & Byers.) As the economy recovered from the dual shocks of the internet bubble and 9/11, Doerr's fellow Silicon Valley VCs were already looking to clean technology as the next big thing. What followed was yet another Silicon Valley gold rush. In 2005, VC investment in clean tech measured in the hundreds of millions of dollars. The following year, it ballooned to $1.75 billion (£1.13bn), according to the US National Venture Capital Association. By 2008, the year after Doerr's speech, it had leapt to $4.1 billion. And the US federal government followed. Through a mix of loans, subsidies and tax breaks, it directed roughly $44.5 billion into the sector between late 2009 and late 2011. Avarice, altruism and policy had aligned to fuel a spectacular boom. Anyone who has heard the name Solyndra knows how this all panned out. Due to a confluence of factors -- including fluctuating silicon prices, newly cheap natural gas, the 2008 financial crisis, China's ascendant solar industry and certain inescapable technological realities -- the clean-tech bubble has burst, leaving us with a traditional energy infrastructure that is still overwhelmingly reliant on fossil fuels. The fallout has hit almost every niche in the clean-tech sector, but none more dramatically than solar. Doerr's Ted talk wasn't the start of this VC-fueled drive for a new-energy economy. Many of the investors and entrepreneurs who had ridden the internet bubble to various levels of success had already started pouring money and ideas into clean tech. One of the first to bet big was Martin Roscheisen. He sold his email-management firm eGroups to Yahoo! for $450 million, and in 2002 he cofounded Nanosolar, a panel manufacturer. Vinod Khosla, cofounder and former CEO of Sun Microsystems, moved his VC firm, Khosla Ventures, heavily into biofuels and other renewables. Andew Beebe, cofounder of the dotcom-era darling Bigstep.com, a web-hosting company, helped start the solar panel maker Energy Innovations in 2003. Arno Harris, who had helped steer what he now calls an "Amazon-Kleiner Perkins online wine store that left a big hole in the ground", worked with Beebe at a subsidiary of Energy Innovations before founding Recurrent Energy, a company that develops utility-scale solar projects, in 2006. PayPal cofounder Elon Musk has put $96 million of his own money into Tesla Motors and was joined by VCs Steve Jurvetson and Nancy Pfund. In 2008, by which time Kleiner Perkins had allocated more than $300 million to clean tech, the firm launched a $500 million growth fund that it said was "intended to help speed mass-market adoption of solutions to the world's climate crisis". Doerr, who told Forbes that curbing climate change was "the largest economic opportunity of the 21st century, and a moral imperative", helped direct money to everything from solar to smart meters. These investors were drawn to clean tech by the same factors that had led them to the web, says Ricardo Reyes, vice president of communications at Tesla Motors. "You look at all disruptive technology in general, and there are some things that are common across the board," Reyes says. "A new technology is introduced in a staid industry where things are being done in a sort of cookie-cutter way." Just as the internet transformed the media landscape and iTunes killed the record store, Silicon Valley electric-car factories and solar companies were going to remake the energy sector. In the US, energy bills passed in 2005 and 2007 provided tax credits and loan guarantees for clean tech, and gave investors further confidence. Venture capital in solar alone rose from $32 million in 2004 to nearly $1.85 billion in 2008. Investment in battery tech rose more than 30-fold during the same period. Around the same time, in 2007, the European Union set a target of making 20 per cent of its energy supply come from renewable sources, spurring further investment in wind-turbine technology in the UK. Other clean-energy sectors were thriving as well, buoyed not only by VC money but by the fact that the average price of electricity in the US had shot up 35 per cent between 2002 and 2008. At the end of 2006, the total capacity of all the wind turbines installed in the US was 11,468 megawatts, enough to power 3.2 million homes. By 2010, it was nearly four times that much. In the UK, there are currently 3,506 turbines, generating some 5,953 megawatts. "As more entrepreneurs and innovators saw there was capital available in the clean-energy sector, you saw more folks looking into developing solutions and business around that," says Joshua Freed, vice president for clean energy at the think tank Third Way. One of these was Chris Gronet, a Stanford PhD in semiconductor processing who had been general manager of the thermal processing group at Applied Materials, a firm that provides equipment and software to semiconductor and solar companies. He had come up with a design for a new solar module (a module is a light-gathering photovoltaic cell with all the attendant structural hardware and circuitry) that he believed would be more efficient than the flat-panel modules that had dominated the market for more than three decades. Conventional photovoltaics are tricky things to install. Under the best conditions -- when their surfaces are clean and aimed directly into the Sun -- they generally operate at no better than 20 per cent efficiency -- just a fifth of the energy striking them is turned to electricity. But an immobile flat surface faces the Sun head-on for only a brief period each day, at best. And simple dust can reduce the efficiency by five to ten per cent. Gronet's design used a grate made of rows of cylindrical cells rather than a single panel of flat cells. The Sun tracking across a cylinder will always be shining directly on part of it. That meant Gronet's modules could be mounted parallel to a roof and out of the wind, rather than angled up into it. As an added bonus, the tubular cells would gather not just direct sunlight but also ambient light reflected off of the rooftops on which they were mounted. At around this time, investors were searching for an alternative to the crystalline silicon used in photovoltaics, which was skyrocketing in price. Increased demand had driven the price of processed silicon from around $50 per kilogram in 2004 to well above $300 by 2008. When the higher production costs were factored in, the price of electricity from solar firms was 17 to 23 cents per kilowatt-hour, even after subsidies. That was about twice the average price of conventionally produced electricity at the time. Gronet's design instead used a mix of copper, indium, gallium and selenium, or CIGS. Though slightly less efficient than silicon in direct sunlight, CIGS performs better under cloud cover and in variable light. The technology had been around for several years but was too expensive to be practical. That changed as soon as silicon climbed above $200 per kilogram. Suddenly CIGS could compete. Gronet incorporated his company in 2005, first calling it Gronet Technologies but quickly changing the name to Solyndra. Gronet and his chief financial officer, Jonathan Michael, set out to raise capital for a factory. By 2007, they had $99 million from sources including RockPort Capital Partners and Argonaut Private Equity and were busy renovating an old Hitachi building in Fremont, California. In 2008, Virgin Green Fund, an investment arm of business icon Richard Branson, chose Solyndra as the only solar company that it would put money into, out of more than 100 that applied for funding. By the end of that year, Solyndra had raised $600 million, boasted more than 500 employees, and had two major orders -- $325 million from Sacramento-based Solar Power and $681 million from a German company called Phoenix Solar. "Everyone was pretty optimistic," recalls Lindsey Eastburn, who was designing factory-automation software for Solyndra. "We were making product, and we were selling it." Just as Solyndra was starting to take off and needed more money for expansion, the venture-capital climate began to cool. The 2008 financial collapse erased a quarter of the gains VC firms had made between 2003 and 2007, and venture investments in clean tech fell from $4.1 billion in 2008 to $2.5 billion in 2009. There was an additional factor at work: impatience. Consider a recent analysis by Matthew Nordan, a venture capitalist who specialises in energy and environmental technology. Of all the energy startups that received their first VC funds between 1995 and 2007, only 1.8 percent achieved what he calls "unambiguous success", meaning an initial public offering on a major exchange. The average time from founding to IPO was 8.3 years. "If you're signing up to build a clean-tech winner," Nordan wrote in a blog post, "reserve a decade of your life." The truth is that starting a company on the supply side of the energy business requires an investment in heavy industry that the VC firms didn't fully reckon with. The only way to find out if a new idea in this sector will work at scale is to build a factory and see what happens. Ethan Zindler, head of policy analysis for Bloomberg New Energy Finance, says the VC community simply assumed that the formula for success in the internet world would translate to the clean-tech arena. "What a lot of them didn't really understand," he says, "is that it's almost never going to be five guys in a garage. You need a heck of a lot of money to prove that you can do your technology at scale." Luckily for the clean-tech industry, a much larger investor stepped in to replace the retreating VCs -- the federal government. \*\*\* In 2005, the US Congress created a federal loan guarantee programme as part of the Energy Policy Act, which initially was authorised at $4 billion. Ostensibly set up to promote nonpolluting energy sources, its focus on then-unpopular nuclear power resulted in the money going more or less untouched. Applications from other clean-energy sectors suddenly had an opportunity. Solar projects would ultimately receive more than three-quarters of the programme's financial support, but the list of recipients included everything from a wind farm in Oregon to a cellulosic ethanol plant in Kansas. But by the time GW Bush left office, not a penny had been distributed. Most of the applications, including one from Solyndra, were still wending their way through the approval rounds at the US Department of Energy (DOE). There were only 16 employees tasked with sorting through the applications. Then Barack Obama took office, and the loan programme suddenly had an administration committed to using federal dollars to stimulate what it referred to repeatedly as "the clean-energy economy". The DOE, which for decades had focused on managing nuclear waste and doling out subsidies to the fossil-fuel industry, had a new leader -- Steven Chu, a physicist and Nobel laureate. US government money dwarfed what VCs had put into clean energy. The loan guarantee programme alone provided more than $16 billion for 28 projects. An additional $12.1 billion went into the sector via tax credits. Federal subsidies for renewable energy nearly tripled between 2007 and 2010, rising from $5.1 billion to $14.7 billion. Solyndra's $535 million loan guarantee closed in September 2009. The firm began construction on a second factory, expanded its workforce to 1,100 employees and paid millions for a custom machine designed to put the finishing touches on the cells at a rate of 60 per minute. Obama even visited the Solyndra factory in May 2010. Yet by autumn of 2010, Solyndra had scuttled plans for a $300 million IPO and was still waiting to hear back on an additional $469 million loan application to help finance its second factory. Although the company's solar modules were working as planned, Solyndra needed to increase its production capacity to get per-unit costs down. The custom machine had turned out to be a dud. A Solyndra module cost at least 30 per cent more per watt than a traditional photovoltaic -- and the gap was growing. Given the concerns about Solyndra's financial viability, the company dropped the request for a second loan. Yet in early 2011, despite further warnings about Solyndra's cashflow, the DOE restructured the original loan, guaranteeing that private investors, not the federal government, would be repaid first in the case of a default. The financial models that had justified the massive investments in clean-energy sources were built on assumptions that the price of fossil fuels, in particular natural gas, would continue to rise. However, a natural-gas boom transformed the energy landscape. As with the internet bubble and the more recent housing bubble, there were signs of trouble. In fact, in the weeks and days leading up to Obama's visit to the Solyndra plant, officials at the Office of Management and Budget were issuing warnings that his endorsement could be premature and eventually embarrassing. In fact, though Solyndra CEO Brian Harrison painted a rosy picture for lawmakers in July 2011 -- boasting that revenue "grew from $6 million in 2008 to $100 million in 2009 to $140 million in 2010" and would nearly double in 2011 -- the truth was laid out in an internal White House memo obtained by The Washington Post after Solyndra filed for bankruptcy. The August 2011 memo, written days before Solyndra went bankrupt, stated simply that "the company has had 0 per cent sales growth since [autumn] 2009". Perhaps clean energy's biggest problem is this: because natural gas has gotten so cheap, there is no longer a financial incentive to go with renewables. The controversial practice of hydraulic fracturing, or fracking, has opened up reserves so massive that the US has surpassed Russia as the world's largest natural-gas supplier. The price of natural gas peaked at nearly $13 per thousand cubic feet in 2008. It now stands at around $3. A decade ago, shale gas accounted for less than two per cent of America's natural gas supply; it is now approaching one-third, and industry officials predict that the total reserves will last a century. Because 24 per cent of US electricity comes from power plants that run on natural gas, that has helped keep costs down to just ten cents per kilowatt-hour-and from a source that creates only half the CO2 pollution of coal. Put all that together and you've undone some of the financial models that say it makes sense to shift to wind and solar. Another blow to the US clean-tech industry was a glut of processed silicon that sent prices back down below $30 a kilogram. That price, combined with the technological simplicity of manufacturing conventional solar panels, opened the door to relatively unsophisticated operators. For example, in 2007, a Chinese textile manufacturer approached Arno Harris, CEO of utility developer Recurrent Energy, to see if he'd be interested in buying solar panels that they hoped to begin making. Understandably, American firms have struggled to remain competitive. In 1995, more than 40 per cent of all silicon-based solar modules worldwide were made in the US; now it's six per cent. China accounts for more than half of global photovoltaic output, and Chinese-made modules are up to 20 per cent cheaper than American ones. Wind has also taken a hit. Not only can the turbines not match the current costs of gas-fired plants, the flood of cheap Chinese solar panels can make them less attractive as a green option, too. The pace of new wind-turbine installations in the US has declined by more than half since 2008. This past October, Cliff Stearns, the Republican chair of the House Energy and Commerce Oversight and Investigations Subcommittee, admitted to National Public Radio what had by then become obvious: "We can't compete with China to make solar panels and wind turbines." The boom has gone bust. And yet, clean tech is far from dead. Certain companies and technologies will emerge from the ruins. Electric cars seem like a relatively safe bet, spurred by both rising oil prices and international standards requiring greater fuel efficiency. As it has with solar, China has pushed into the battery industry. As a result, prices for the lithium-ion battery modules in electric cars -- which can cost more than some gas-powered cars -- are coming down. Tesla started out making 600 sports cars a year, priced at $109,000 each; within five years, the company says, it will be producing 100,000 cars annually and charging just $30,000 apiece. Distributed-generation businesses -- the firms that install solar systems to power individual homes and offices -- are thriving because of a financing model more akin to an office leasing a photocopier. A decade ago, a rooftop solar array for a 280m2 home would have cost the owner about $45,000. The price can now be less than $20,000 -- but instead of having to pay it up front, homeowners can lease the systems from companies such as San Mateo, California-based SolarCit for $119 a month -- less than many electricity bills. But there is still an investor: the taxpayer. US government coffers have been compensating for a number of market challenges solar faces, including the incumbency advantage of the fossil-fuel industry. In the UK, homeowners who install solar panels are paid 43p per kilowatt-hour they generate; however, the government is attempting to cut this by half, making domestic solar far less attractive. Even solar's biggest allies on Capitol Hill -- people such as Edward J Markey, a top Democrat on the House Energy and Commerce Committee -- fear the industry's oil and gas foes may have gotten the upper hand. "The fossil-fuel industry and its allies in Congress see the solar and wind industries as a threat and will try to kill these industries as they have for the preceding two generations," Markey says. "They want this to be a five-year aberrational period." John Doerr may once again have a good reason to shed a tear.

### Renewable Energy Fails – General

#### Renewable energy insufficient to replace fossil fuels and meet rising energy demand: requires huge land mass and significant new installments every year.

Bryce 6/11 (Robert, “Dreaming the Impossible Green Dream” from Wall Street Journal, Mr. Bryce is a senior fellow at the Manhattan Institute. His most recent book, "Smaller Faster Lighter Denser Cheaper: How Innovation Keeps Proving the Catastrophists Wrong," was published in May by Public Affairs, http://webcache.googleusercontent.com/search?q=cache:online.wsj.com/articles/robert-bryce-dreaming-the-impossible-green-dream-1402527502)

In the June 5 issue of Rolling Stone magazine, Bill McKibben declares his desire to "set the world on a fundamentally new course." He's inviting fellow climate-change activists to participate in a "People's Climate March" in New York City on Sept. 20—which he hopes will be the "largest demonstration yet of human resolve in the face of climate change." Mr. McKibben is among the world's most famous environmentalists. He's written or edited 15 books and been awarded honorary degrees from 18 colleges and universities. He is also the founder of 350.org, whose goal is to reduce atmospheric carbon-dioxide levels to 350 parts per million from the current level of about 400 parts per million. To achieve that goal, he's written that "we need to cut our fossil fuel use by a factor of twenty over the next few decades." But what are the actual implications of cutting fossil fuels 20-fold? Let's "do the math," as Mr. McKibben is fond of saying. Global hydrocarbon consumption is now about 218 million barrels of oil equivalent energy a day, according to the BP Statistical Review of World Energy, which includes 83 million barrels of oil as well as about 75 million barrels of oil equivalent from coal and about 60 million barrels of oil equivalent from natural gas. Reducing that by a factor of 20 would cut global hydrocarbon use to the energy equivalent of 11 million barrels of oil a day, roughly the amount of energy now consumed by India, where 400 million people lack access to electricity. In 2012, the average resident of planet Earth consumed about 1.3 gallons of oil-equivalent energy a day from hydrocarbons. If Mr. McKibben's plan were enacted—and we shared those available hydrocarbons equally—-each of us would be allotted about eight fluid ounces of oil-equivalent energy from hydrocarbons a day. Today, the average resident of Bangladesh uses about half a liter of oil equivalent—slightly less than 17 ounces—a day. Under Mr. McKibben's prescription, the average Bangladeshi would be required to cut his hydrocarbon use by about half. Like many others among the green left, Mr. McKibben insists that the prospect of catastrophic climate change means we must rely solely on renewable energy (and no nuclear power, either). What would that mean? Again, let's "do the math." And to keep it simple, let's ignore oil (even though it accounts for about a third of all energy consumption) and focus solely on electricity. Over the past three decades, according to the BP Review, global electricity demand has been growing by about 450 terawatt-hours a year. And the International Energy Agency expects power demand will continue growing by about that pace for the next two decades. What would be required if we relied on solar energy to keep up with expected growth in electricity demand? Let's look at Germany, which has more solar capacity than any other country, about 33,000 megawatts. In 2012 those solar facilities produced 28 terawatt-hours of electricity. Thus the world would have to install about 16 times as much photovoltaic capacity as Germany's entire installed base, and it would have to do so every year. Wind? Merely to keep pace with the global growth in electricity demand would require the installation of about 280,000 megawatts of new wind-energy capacity every year. According to several academic studies, the areal power density of wind energy—that is, the amount of power that can be derived from a given amount of land—is about one watt per square meter. This means that installing the requisite additional wind capacity would require covering about 280,000 square kilometers (108,000 square miles of land)—an area nearly the size of Italy—with wind turbines, every year. (For comparison, the areal power density of nuclear power is more than 50 watts per square meter. The productivity of oil and gas wells vary, but even marginal wells have power densities of about 27 watts per square meter.) Late last month I emailed Mr. McKibben, asking for his calculations regarding the energy-supply, land-use, or economic implications of his 20-fold reduction plan for hydrocarbons. His response included no math on the quantity of hydrocarbons available, nor any numbers for expected land use, or costs. Instead Mr. McKibben pointed mainly to a report earlier this year by Mark Jacobson, an engineering professor at Stanford University, which claims that wind, water and solar could meet all U.S. energy demand by 2050. That document, in turn, refers largely to a 2010 paper Mr. Jacobson published in the journal Energy Policy, which rests heavily on the assumption that some type of electricity-storage system will be invented so that we can store the intermittent energy harnessed from the wind and sun. How reasonable is that assumption? Energy storage, Mr. Jacobson writes, "is a critical area for new research." My email to Mr. McKibben also inquired about the need for refined petroleum products in transportation and aviation. His response ignored aviation but replied that "we've made great strides in electrifying vehicles." The energy he collects from the solar panels on his house, he wrote, can power his Ford C-Max on "most days." Here's a suggestion: As a test of his scheme to cut hydrocarbon use 20-fold, Mr. McKibben and his allies making the pilgrimage to the September climate-change march, should be required to travel to New York City in solar-powered cars. If there aren't enough of those, they should be required to walk to the Big Apple. It will be a good test. For if policy makers implement Mr. McKibben's energy plan, we'll all be walking. A lot.

#### Renewables don’t produce enough energy to stop climate change, and fossil fuel companies have no incentive to abandon their extremely valuable infrastructure.

Chatsko, 2/2(“Why Renewable Energy Won't Save Us from Climate Change” By Maxx Chatsko, February 2, 2014, the Motley Fool, http://www.fool.com/investing/general/2014/02/02/why-renewable-energy-wont-save-us-from-climate-cha.aspx)

Renewable energy installations have soared in recent years. Wind energy has grown at an average rate of 30% since 2007 and now supplies 3.4% of the nation's electricity. The photovoltaic segment of the solar industry grew at a 35% clip in the year preceding the third quarter of 2013. More impressive is the fact that residential solar installations from companies such as REC Solar, SolarCity (NASDAQ: SCTY ) , and SunPower (NASDAQ: SPWR ) have grown at a nearly 50% annual clip in recent years. Even energy generators are getting in on the action. NextEra Energy (NYSE: NEE ) generates 52%, or 9.2 gigawatts, of its power from wind and another 19% from nuclear, hydroelectric, and solar power. Numerous other power generators have increased the presence of renewables in their portfolios in the last decade. That means we can sit back and watch climate change worries vanish into the midday sun and cool summer breeze, right? Not quite. James Hansen, the former chief climate scientist at NASA, captured headlines in early January by smacking green enthusiasts with a dose of reality at a press conference held to discuss a climate change study titled Assessing "Dangerous Climate Change": Required Reduction of Carbon Emissions to Protect Young People, Future Generations and Nature. His central argument was that relying on renewable technology to save planet Earth from the devastating effects of climate change was irresponsible and impossible, instead suggesting that the world needed vast quantities of nuclear power to have any real shot at averting disaster. You may not agree with Hansen's comments, but the hard numbers prove him correct. Here's what the data show and how it could affect your investments. Easter Bunny. Tooth Fairy. Renewables? Hansen didn't pull any punches in delivering his message: Suggesting that renewables will let us phase rapidly off fossil fuels in the United States, China, India, or the world as a whole is almost the equivalent of believing in the Easter Bunny and Tooth Fairy. Sorry, kids. It's a bit harsh, but it accurately conveys reality. Barring a significant and overnight technological advancement that makes renewable energy drastically cheaper, more accessible, and more efficient than existing sources of energy (including current-generation renewables), renewable technologies are not our best bet to combat climate change. For instance, despite the impressive growth of solar installations the entire solar industry only generates 0.12% of the nation's electricity. Wind has been more successful -- and got a technological head start -- but still accounts for just 3.4%. I actually think that's quite impressive, especially considering that wind energy generation increased more than 23-fold from 2000 to 2012. But it means little in the grand scheme of things. In 2000, renewable energy as a whole -- wind, solar, hydroelectric, geothermal, wood, and waste -- generated 9% of the nation's electricity. Despite the impressive growth in the years since, the United States will likely only generate about 13% of its electricity from renewable sources. Worse yet, traditional renewables (wind and solar) will generate slightly more than 3.5% of the total. We could -- and probably will -- produce a majority of our energy from renewable sources one day in the future, but if that future is decades from now it will be too late. We need to take climate action now. What does it mean for your investments? Renewables alone may not help the world avert a climate disaster, but that fact doesn't alter the investment thesis for companies such as SolarCity, SunPower, or NextEra Energy. In fact, it may bolster the reasons to own the companies. Why? Each company offers a solution to one or more of the problems plaguing the large-scale adoption of renewable energy. Consider that the residential and commercial solar platforms of SolarCity and SunPower crush the obstacle of geography. The bulk of renewable resources are located in geographically remote regions far from urban centers that consume the most electricity. It simply isn't realistic to build large new transmission lines -- or even tap into existing lines -- to distribute renewable power throughout the grid. Enabling households and businesses to generate power locally certainly solves that issue, which partially explains the exploding growth opportunities for SolarCity and SunPower. ^SPX Chart ^SPX data by YCharts. Another problem with thinking traditional renewables will quickly provide any significant portion of the nation's electricity is the obstacle of replacement. A recent article in Scientific American estimated that fossil-fuel-related infrastructure had a global value of $20 trillion. Why, then, should we expect global companies to abandon their capital-intensive assets already in the ground and with years of useful life ahead of them in favor of more capital-intensive renewable assets? The numbers simply don't work. NextEra Energy is proving that power generation portfolios don't need to rely on fossil fuels for the majority of their capacity. When older, dirtier power plants are retired and utilities search for cleaner, cheaper sources of generation, NextEra will have the national reach and expertise to answer the call. It's also difficult to argue with the combination of market growth, dividends (3% at the moment), and a swelling bottom line offered by the company. Foolish takeaway The growth of renewable energy in terms of technological advancement (increased efficiency, falling costs) and contributions to the national grid is impressive and welcome. It will certainly play a critical role in reducing the world's reliance on energy imports, and will help in answering the challenges presented by climate change. However, renewable energy alone won't be the planet's savior. It's important to note that Hansen isn't saying renewable energy represents a waste of research dollars or that it should be abandoned. Neither am I.That doesn't mean investment opportunities don't exist and, as I've outlined, it may even strengthen the investment thesis in renewable technologies. Will renewable energy continue its torrid pace of growth? There's a huge difference between a good stock and a stock that can make you rich. There may be a massive opportunity in residential solar for SolarCity and SunPower, but with such large share gains in recent years investors may be wondering how much growth is left in the tank. Luckily, the Motley Fool's chief investment officer has selected his No. 1 stock for 2014, and it's one of those stocks that could make you rich. You can find out which stock it is in the special free report "The Motley Fool's Top Stock for 2014." Just click here to access the report and find out the name of this under-the-radar company. Maxx Chatsko has no position in any stocks mentioned. Check out his personal portfolio, his CAPS page, his previous writing for The Motley Fool, or his work for the SynBioBeta Blog to keep up with developments in the synthetic biology industry. The Motley Fool recommends SolarCity. The Motley Fool owns shares of SolarCity. Try any of our Foolish newsletter services free for 30 days. 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### Renewable Energy Fails – Economy

#### Investment in renewables hurts the economy: bankruptcy and corruption mean that failure is more likely than success.

The Daily Signal, 12 (Ashe Schow, “President Obama’s Taxpayer-Backed Green Energy Failures”, October 18, 2012, http://dailysignal.com/2012/10/18/president-obamas-taxpayer-backed-green-energy-failures/)

It is no secret that President Obama’s and green energy supporters’ (from both parties) foray into venture capitalism has not gone well. But the extent of its failure has been largely ignored by the press. Sure, single instances garner attention as they happen, but they ignore past failures in order to make it seem like a rare case. The truth is that the problem is widespread. The government’s picking winners and losers in the energy market has cost taxpayers billions of dollars, and the rate of failure, cronyism, and corruption at the companies receiving the subsidies is substantial. The fact that some companies are not under financial duress does not make the policy a success. It simply means that our taxpayer dollars subsidized companies that would’ve found the financial support in the private market. So far, 34 companies that were offered federal support from taxpayers are faltering — either having gone bankrupt or laying off workers or heading for bankruptcy. This list includes only those companies that received federal money from the Obama Administration’s Department of Energy and other agencies. The amount of money indicated does not reflect how much was actually received or spent but how much was offered. The amount also does not include other state, local, and federal tax credits and subsidies, which push the amount of money these companies have received from taxpayers even higher. The complete list of faltering or bankrupt green-energy companies: Evergreen Solar ($25 million)\* SpectraWatt ($500,000)\* Solyndra ($535 million)\* Beacon Power ($43 million)\* Nevada Geothermal ($98.5 million) SunPower ($1.2 billion) First Solar ($1.46 billion) Babcock and Brown ($178 million) EnerDel’s subsidiary Ener1 ($118.5 million)\* Amonix ($5.9 million) Fisker Automotive ($529 million) Abound Solar ($400 million)\* A123 Systems ($279 million)\* Willard and Kelsey Solar Group ($700,981)\* Johnson Controls ($299 million) Brightsource ($1.6 billion) ECOtality ($126.2 million) Raser Technologies ($33 million)\* Energy Conversion Devices ($13.3 million)\* Mountain Plaza, Inc. ($2 million)\* Olsen’s Crop Service and Olsen’s Mills Acquisition Company ($10 million)\* Range Fuels ($80 million)\* Thompson River Power ($6.5 million)\* Stirling Energy Systems ($7 million)\* Azure Dynamics ($5.4 million)\* GreenVolts ($500,000) Vestas ($50 million) LG Chem’s subsidiary Compact Power ($151 million) Nordic Windpower ($16 million)\* Navistar ($39 million) Satcon ($3 million)\* Konarka Technologies Inc. ($20 million)\* Mascoma Corp. ($100 million) \*Denotes companies that have filed for bankruptcy. The problem begins with the issue of government picking winners and losers in the first place. Venture capitalist firms exist for this very reason, and they choose what to invest in by looking at companies’ business models and deciding if they are worthy. When the government plays venture capitalist, it tends to reward companies that are connected to the policymakers themselves or because it sounds nice to “invest” in green energy. The 2009 stimulus set aside $80 billion to subsidize politically preferred energy projects. Since that time, 1,900 investigations have been opened to look into stimulus waste, fraud, and abuse (although not all are linked to the green-energy funds), and nearly 600 convictions have been made. Of that $80 billion in clean energy loans, grants, and tax credits, at least 10 percent has gone to companies that have since either gone bankrupt or are circling the drain. CORRECTION: Figures for four companies have been updated: Beacon Power received $43 million from the U.S. government, not $69 million as originally reported. Azure Dynamics received $5.4 million from the federal government, not $120 million as originally reported. Compact Power Inc. received $151 million as part of the stimulus, not $150 million as originally reported. Willard and Kelsey Solar Group received $700,981 in government funding, not $6 million as originally reported. The following companies have been removed from the original list: AES’s subsidiary Eastern Energy, LSP Energy, Schneider Electric, and Uni-Solar did not receive government-backed loans, based on additional research. The National Renewable Energy Lab did received $200 million in stimulus funding, but it is a government laboratory.

## Grid DA

### Grid DA 1NC

#### An increase in renewable energy generation causes grid collapse

Gloystein, 13 – (Henning Gloystein, Reuters, “Unreliable renewable energy is hitting quality”, <http://www.irishexaminer.com/business/unreliable-renewable-energy-is-hitting-quality-245524.html>)

Britain’s power grid is balanced around a frequency of 50Hz. Any major deviation above or below this level hits the quality of electric supplies, causing flickering of light bulbs and, in the worst case, blackouts. Maintaining a frequency of 50Hz has not been a big challenge in the past as Britain’s electricity was produced by a generation of gas, nuclear, and coal-fired power stations, controlled by a handful of utilities. But experts warn that the rise of decentralised and unreliable renewable capacity, such as wind, makes it more difficult to maintain a stable frequency, reducing the quality of supplies and potentially collapsing the grid. The European Network of Transmission System Operators for Electricity (Entsoe) said a subsidy-fuelled boom in renewable capacity across Europe had coincided in a quality drop of the power frequency. Entsoe also said a clash of low renewables with a major capacity outage such as the power link between France and Britain would pose “a severe risk for the system to collapse”. “As you put more renewables into the system you will lose flexibility and have more flickering and also increase the threat of frequency outages,” said Andrew Jones, Europe’s managing director for US based S&C Electric, a provider of equipment and services for electric power systems. “All you need is an interconnector or a big station to go out at the same time as winds drop off and you will have a frequency-based outage,” Jones said. National Grid, which operates Britain’s power transmission system, has also warned of a drop in electricity quality. “The reduction in fault levels weakens the overall strength of the network which in turn can give rise to quality of supply issues such as large voltage steps, harmonics and flicker,” National Grid said. A decade ago, Britain had almost no renewable power capacity installed and instead relied on a mix of gas, coal, and nuclear generation. Today, it receives around 10% of its electricity from renewable sources, and by 2020 Britain’s share of installed renewable capacity is expected to reach 20%. Falling frequency is caused by a lack in power production, while rising frequency is triggered by a surplus of power. Dynamic Demand, a renewable energy consultancy, says that a frequency around 48.5Hz would result in local blackouts and a frequency of 52Hz or more would cause power stations to trip and forcefully shut down. National Grid says the last reportable frequency event occurred in 2008, when an unplanned loss of 1,714mW of power generation capacity cut system frequency to 48.15Hz. “These events resulted in the system frequency being outside of National Grid’s lower statutory limit of 49.5Hz for nine minutes,” National Grid said. There had been another frequency anomaly in the mid-1990s. Data from Entsoe shows that continental Europe has seen a strong rise in renewable capacity in the last 10 years, alongside a sharp rise in the duration and number of frequency events.

#### Blackouts risks nuclear meltdowns

Cappiello, 11 (3/29/2011, Dina, “AP IMPACT: Long blackouts pose risk to US reactors,” <http://www.utsandiego.com/news/2011/mar/29/ap-impact-long-blackouts-pose-risk-to-us-reactors/)>

WASHINGTON — It's a nightmarish scenario - a days-long blackout at a nuclear power plant leading to a radioactive leak. Though the odds of that happening are extremely remote, an Associated Press investigation has found that some U.S. plants are more vulnerable than others. Long before the nuclear emergency in Japan, U.S. regulators knew that a power failure lasting for days at an American nuclear plant, whatever the cause, could lead to a radioactive leak. Even so, they have only required the nation's 104 nuclear reactors to develop plans for dealing with much shorter blackouts on the assumption that power would be restored quickly. In one simulation presented by the Nuclear Regulatory Commission in 2009, it would take less than a day for radiation to escape from a reactor at a Pennsylvania nuclear power plant after an earthquake, flood or fire knocked out all electrical power and there was no way to keep the reactors cool after backup battery power ran out. That plant, the Peach Bottom Atomic Power Station outside Lancaster, has reactors of the same older make and model as those releasing radiation at Japan's Fukushima Dai-ichi plant, which is using other means to try to cool the reactors. And like Fukushima Dai-ichi, the Peach Bottom plant has enough battery power on site to power emergency cooling systems for eight hours. In Japan, that wasn't enough time for power to be restored. According to the International Atomic Energy Agency and the Nuclear Energy Institute trade association, three of the six reactors at the plant still can't get power to operate the emergency cooling systems. Two were shut down at the time. In the sixth, the fuel was removed completely and put in the spent fuel pool when it was shut down for maintenance at the time of the disaster. A week after the March 11 earthquake, diesel generators started supplying power to two other two reactors, Units 5 and 6, the groups said. The risk of a blackout leading to core damage, while extremely remote, exists at all U.S. nuclear power plants, and some are more susceptible than others, according to an Associated Press investigation. While regulators say they have confidence that measures adopted in the U.S. will prevent or significantly delay a core from melting and threatening a radioactive release, the events in Japan raise questions about whether U.S. power plants are as prepared as they could and should be. As part of a review requested by President Barack Obama in the wake of the Japan crisis, a top Nuclear Regulatory Commission official said Tuesday that the agency will investigate whether the nation's nuclear reactors are capable of coping with station blackouts and whether regulatory requirements need to be strengthened. Bill Borchardt, the agency's executive director for operations, said an obvious question is whether nuclear plants need enhanced battery supplies, or ones that can last longer. "There is a robust capability that exists already, but given what happened in Japan there's obviously a question that presents itself: Do we need to make it even more robust," he said at a hearing before the Senate Energy and Natural Resources Committee. "We didn't address a tsunami and an earthquake, but clearly we have known for some time that one of the weak links that makes accidents a little more likely is losing power," said Alan Kolaczkowski, a retired nuclear engineer who worked on a federal risk analysis of Peach Bottom released in 1990 and is familiar with the updated risk analysis. Risk analyses conducted by the plants in 1991-94 and published by the commission in 2003 show that the chances of such an event striking a U.S. power plant are remote, even at the plant where the risk is the highest, the Beaver Valley Power Station in Pennsylvania. These long odds are among the reasons why the United States since the late 1980s has only required nuclear power plants to cope with blackouts for four or eight hours. That's about how much time batteries would last. After that, it is assumed that power would be restored. And so far, that's been the case. Equipment put in place after the Sept. 11, 2001, terrorist attacks could buy more time. Otherwise, the reactor's radioactive core could begin to melt unless alternative cooling methods were employed. In Japan, the utility has tried using portable generators and dumping tons of seawater, among other things, on the reactors in an attempt to keep them cool. A 2003 federal analysis looking at how to estimate the risk of containment failure said that should power be knocked out by an earthquake or tornado it "would be unlikely that power will be recovered in the time frame to prevent core meltdown." In Japan, it was a one-two punch: first the earthquake, then the tsunami. Tokyo Electric Power Co., the operator of the crippled plant, found other ways to cool the reactor core and, so far, avert a full-scale meltdown without electricity. "Clearly the coping duration is an issue on the table now," said Biff Bradley, director of risk assessment for the Nuclear Energy Institute. "The industry and the Nuclear Regulatory Commission will have to go back in light of what we just observed and rethink station blackout duration." David Lochbaum, a former plant engineer and nuclear safety director at the advocacy group Union of Concerned Scientists, put it another way: "Japan shows what happens when you play beat-the-clock and lose." At Tuesday's Senate committee hearing, he said the government and the nuclear power industry have to do more to cope with prolonged blackouts, such as having temporary generators on site - or at nearby military bases - that can recharge batteries. A complete loss of electrical power, generally speaking, poses a major problem for a nuclear power plant because the reactor core must be kept cool, and back-up cooling systems - mostly pumps that replenish the core with water- require massive amounts of power to work. Without the electrical grid, or diesel generators, batteries can be used for a time, but they will not last long with the power demands. And when the batteries die, the systems that control and monitor the plant can also go dark, making it difficult to ascertain water levels and the condition of the core. Eleven U.S. reactors are designed to cope with a station blackout lasting eight hours, while 93 are designed for four-hour blackouts.

#### Impact is on par with nuclear warfare – fallout will be massive and global

Drell, Professor emeritus of theoretical physics at the SLAC National Accelerator Laboratory at Stanford University, senior fellow at the Hoover Institution, and a member of the President's Foreign Intelligence Advisory Board and Science Advisory Committee, 12

(THE NUCLEAR ENTERPRISE High-Consequence Accidents: How to Enhance Safety and Minimize Risks in Nuclear Weapons and Reactors, pg. 1-3)

We live in dangerous times for many reasons. Prominent among them is the existence of a global nuclear enterprise made up of weapons that can cause damage of unimaginable proportions and power plants at which accidents can have severe, essentially unpredictable consequences for human life. For all of its utility and promise, the nuclear enterprise is unique in the enormity of the vast quantities of destructive energy that can be released through blast, heat, and radioactivity. We addressed just this subject in a conference in October 2011 at Stanford University's Hoover Institution. The complete set of papers prepared for the conference is reproduced in this book. The conference included experts on weapons, on power plants, on regulatory experience, and on the development of public perceptions and the ways in which these perceptions influence policy7. The reassuring outcome of the conference was a general sense that the U.S. nuclear enterprise currently meets very high standards in its commitment to safety and security. That has not always been the case in all aspects of the nuclear enterprise. And the unsettling outcome of the conference was that it will not be the case globally unless governments, international organizations, industry7, and media recognize and address the nuclear challenges and mounting risks posed by a rapidly changing world. The acceptance of the nuclear enterprise is now being challenged by concerns about the questionable safety and security of programs primarily in countries relatively new to the nuclear enterprise, and the potential loss of control to terrorist or criminal gangs of fissile material that exists in such abundance around the world. In a number of countries, confidence in nuclear energy production was severely shaken in the spring of 2011 by the Fukushima nuclear reactor plant disaster. And in the military sphere, the doctrine of deterrence that remains primarily dependent on nuclear weapons is seen in decline due to the importance of non-state actors such as al Qaeda and terrorist affiliates that seek destruction for destruction's sake. We have two nuclear tigers by the tail. When risks and consequences are unknown, undervalued, or ignored, our nation and the world are dangerously vulnerable. Nowhere is this risk-consequence equation more relevant than with respect to the nucleus of the atom. The nuclear enterprise was introduced to the world by the shock of the devastation produced by two atomic bombs hitting Hiroshima and Nagasaki. Modern nuclear weapons are far more powerful than those early bombs, which presented their own hazards. Early research depended on a program of atmospheric testing of nuclear weapons. In the early years following World War II, the impact and the amount of radioactive fallout in the atmosphere generated by above-ground nuclear explosions was notfully appreciated. During those years, the United States and also the Soviet Union conducted several hundred tests in the atmosphere that created fallout. The recent Stanford conference focused on a regulatory weak point from that time that exists in many places today, as the Fukushima disaster clearly indicates. The U.S. Atomic Energy Commission (AEC) was initially assigned conflicting responsibilities: to create an arsenal of nuclear weapons for the United States to confront a growing nuclear-armed Soviet threat; and, at the same time, to ensure public safety from the effects of radioactive fallout. The AEC was faced with the same conundrum with regard to civilian nuclear power generation. It was charged with promoting civilian nuclear power and simultaneously protecting the public. Progress came in 1963 with the negotiation and signing of the Limited Test Ban Treaty (LTBT) banning all nuclear explosive testing in the atmosphere (initially by the United States, the Soviet Union, and the United Kingdom). With the successful safety7 record of the U.S. nuclear weapons program, domestic anxiety about nuclear weapons receded somewhat. Meanwhile, public attitudes toward nuclear weapons reflected recognition of their key role in establishing a more stable nuclear deterrent posture in the confrontation with the Soviet Union. The positive record on safety of the nuclear weapons enterprise in the United States—there have been accidents involving nuclear weapons, but none that led to the release of nuclear energy—was the result of a strong effort and continuing commitment to include safety as a primary criterion in new weapons designs, as well as careful production, handling, and deployment procedures. The key to the health of today's nuclear weapons enterprise is confidence in the safety7 of its operations and in the protection of special nuclear materials against theft. One can imagine how different the situation would be today if there had been a recognized theft of material sufficient for a bomb, or if one of the two four-megaton bombs dropped from a disabled B-52 Strategic Air Command bomber overflying Goldsboro, North Carolina, in 1961 had detonated. In that event, just one switch in the arming sequence of one of the bombs, by remaining in its "off position" while the aircraft was disintegrating, was all that prevented a full-yield nuclear explosion. A close call indeed! In the twenty-six years since Chernobyl, the nuclear power industry has strengthened its safety practices. Over the past decade, growing concerns about global warming and energy independence have actually strengthened support for nuclear energy in the United States and many nations around the world. Yet despite these trends, the civil nuclear enterprise remains fragile. Following Fukushima, opinion polls gave stark evidence of the public's deep fears of the invisible force of nuclear radiation, shown by public opposition to the construction of new nuclear power plants in close proximity. It is not simply a matter of getting better information to the public but of actually educating the public about the true nature of nuclear radiation and its risks. Of course, the immediate task of the nuclear power component of the enterprise is to strive for the best possible safety record with one overriding objective: no more Fukushimas. Another issue that must be resolved involves the continued effectiveness of a policy of deterrence that remains primarily dependent upon nuclear weapons, and the hazards these weapons pose due to the spread of nuclear technology and material. There is growing apprehension about the determination of terrorists to get their hands on weapons or, for that matter, on the special nuclear material—plutonium and highly enriched uranium—that fuels them in the most challenging step toward developing a weapon. The global effects of a regional war between nuclear-armed adversaries such as India and Pakistan would also wield an enormous impact, potentially involving radioactive fallout at large distances caused by a limited number of nuclear explosions. This is true as well for nuclear radiation from a reactor explosion—fallout at large distances would have a serious societal impact on the nuclear enterprise. There is little understanding of the reality and potential danger of consequences if such an event were to occur halfway around the world. An effort should be made to prepare the public by providing information on how to respond to such an event.

### 2NC Uniqueness

#### Renewable growth slowing now --- declining investment

Woody, 3/12 (Todd, 3/12/2013, “Is the renewable energy boom slowing down?” <http://qz.com/62147/is-the-renewable-energy-boom-slowing-down/>))

The numbers are in on 2012 and it was not the best of years for renewable energy, according to a report released today by market research firm Clean Edge. After years of breakneck growth, the value of global wind industry installations rose by just $2.3 billion from the previous year to $73.8 billion in 2012. Worldwide wind capacity jumped to a record 44,700 megawatts, but that was only about 8% up on the previous year.The value of photovoltaic installations actually fell for the first time, from $91.6 billion in 2011 to $79.7 billion in 2012, as solar panel prices continued to plummet and Chinese manufacturers grappled with overcapacity. Total solar capacity hit a record 30,900 megawatts in 2012 but revenues fell for the first time in a dozen years. Biofuels were the one bright spot, with the market growing to $95.2 billion in 2012 from $83 billion the previous year. Global-markets-for-alternative-energy Last year “proved to be an unsettling and difficult year for clean energy,” the report’s authors wrote. “High-profile bankruptcies and layoffs plagued many clean-tech companies, overall venture investments retreated in the face of increasingly elusive returns, and the industry was begrudgingly transformed into a partisan wedge issue during the highly contentious US presidential campaign.” So why does the green energy business seem to be in something of a funk? The shale gas boom is one reason, allowing investors and utilities to look forward to a cheaper, cleaner-burning fossil fuel that can provide power around the clock. The upheaval in the Chinese solar industry, home to 80% of the world’s photovoltaic manufacturing, and the failure of US startups developing next-generation solar technology to gain ground has also unnerved investors. And advanced biofuels have yet to make a commercial impact. Still, Clean Edge estimates that the global wind, solar and biofuels market will grow from $248.7 billion in 2012 to $426.1 billion in 2022. And to put 2012 in perspective, the value of the worldwide wind market a decade ago was just $4 billion, the solar market was worth $2.5 billion, and the biofuels market was too small for Clean Edge to measure. Venture capitalists’ enthusiasm for green technologies has waned as the market has grown and renewable-energy projects have reached the kind of size that needs more heavyweight funding. Total investment dropped from $5 billion in 2012 from $6 billion in the previous year. Luckily, investors like Warren Buffett have stepped into the void. Buffett’s MidAmerican Energy Holdings, for instance, recently acquired two California solar power plants for $2 billion while Google has invested $200 million into a Texas wind farm. Google alone now has invested in renewable energy projects that generate 2,000 megawatts of electricity, enough to power 500,000 average American households at peak output—or a whole lot of server farms.

### 2NC Link

#### Renewable energy causes grid instability.

J. D. Heyes January 27, 2014(Too much green energy could lead to sudden collapse of power grid http://www.naturalnews.com/043651\_green\_energy\_power\_grid\_electrical\_infrastructure.html#ixzz35gV3IejV)

But in the race by some states like California to bolster the use of wind, solar and geothermal power, those forms of alternative energy, as well as others, are creating new worries for energy officials. The problem? Renewable energy places unprecedented levels of stress on a grid that was designed for 20th century America. As noted by the Times: Green energy is the least predictable kind. Nobody can say for certain when the wind will blow or the sun will shine. A field of solar panels might be cranking out huge amounts of energy one minute and a tiny amount the next if a thick cloud arrives. In many cases, renewable resources exist where transmission lines don't. So, ecological concerns aside, we seem to have gotten ahead of ourselves in terms of the electrical infrastructure needed to handle these new technologies. "The grid was not built for renewables," Trieu Mai, senior analyst at the National Renewable Energy Laboratory, told the paper. That said, it is not as if there is no effort to upgrade the current grid. In fact, as the paper noted, state and federal government officials who are concerned that the 20th century grid will hinder efforts to reduce greenhouse gases are investing billions of taxpayer and ratepayer dollars to "hasten the technological breakthroughs needed for the grid to keep up with the demands of clean energy.

### 2NC Link Magnifier

#### Local failures spread fast to other regions, causing a massive blackout

Makovich, Cambridge Energy Research Associates, ‘03

[Larry, Senior Director of Americas Research at CERA, Capital Hill Hearing Testimony, FDCH, Committee: House Energy and Commerce, Headline: Power Blackouts, September 4, l/n]

As power system conditions change (supply, demand, weather, etc.), power flows reroute at close to the speed of light. Thus, when a generating unit and a transmission line trip and power reroutes, several transmission lines carry more power and, as expected, begin to sag. On August 14, one of these lines carrying more power near Cleveland sagged close enough to a tree to short circuit. Proper maintenance (tree trimming) should prevent such contact but, again, transmission line failures of various types are something power system operators also plan for. Nevertheless, when power rerouted along the remaining lines, additional overloading occurred and automatic protections for generating plants and transmission lines disconnected additional power plants and lines in the network. At some point, the multiple failures pushed the system past its limits to isolate and restabilize. Consequently, the problem expanded over a larger area of the power network as significant rerouting of power flows continued. When a power system is not configured to contain a normal component failure, the destabilization of a larger part of the power system quickly follows. Power surges spread through some parts of the network-Pennsylvania, New Jersey and Maryland, and AEP-that reacted (both automatically and with discretion) to isolate themselves in order to maintain stable system operations. However, such actions add to the rerouting dynamics of the remaining power network and begin to overwhelm the remaining parts such as eastern Michigan, Ontario, and finally New York. The root cause of the cascading blackout appears to be a breakdown in the planning, coordination, and communication necessary to control the interconnected power systems. The sequence of events in the blackout caused parts of the power system to act on their own rather than in a coordinated fashion. Such coordination has not gotten the proper investments of time, money, and systems in the past several years and this system deterioration-the cumulative effects of years of underinvestment in the varied needs of transmission networksis a root cause of the blackout. Past Efforts to Prevent and Minimize Blackouts The blackouts of 1965 and 1977 in the Northeast and in 1996 in the West spurred efforts to prevent and minimize blackouts in the future. The lesson from 1965 was that greater integration of regional power systems created desirable day-to-day benefits from electric trade but required an associated higher level of planning, coordination, communication, and control to prevent cascading power outages. As a result, the formation of the North American Electric Reliability Council (NERC) and its regional reliability councils followed the 1965 blackout. The lesson from the two blackouts of 1996 in the West was that a breakdown in planning, coordination, communication, and control can allow normal events-again, in one case, a power line sagging into a tree-to cascade into a large regional system failure. In this case, the cascading failure began with federally owned transmission assets that were highly integrated with other publicly and privately owned transmission infrastructure. Following the 1996 blackouts, the western power system decreased the amount of power flowing on transmission lines (forgoing savings from increased power trade) in order to maintain the level of redundancy necessary to prevent a repeat of cascading failures following normal component failures. A year or more passed before the planning and coordination got to the point that these power transfer limits could return to pre-blackout levels. The blackouts of 1977 in New York and several years ago in Chicago highlighted the problem of underinvestment in power delivery systems. In Chicago the problem was underinvestment in distribution (the small wires near homes) rather than in transmission (the large wires that carry power long distances). Even the best planning and coordination to properly manage a power system cannot offset the problems created by continued underinvestment. Eventually the probability of multiple component failures and the increasing constraints on systems operators charged with configuring a reliable power system leads to a major blackout. This underinvestment affects more than just transmission lines and substations and includes computer systems, backup systems, software, instrumentation, data, rules, and organizations.

### Impact – Economy

#### Grid outages hurt the economy – empirics prove

US Department of Energy august 2013(ECONOMIC BENEFITS OF INCREASING ELECTRIC GRID RESILIENCE TO WEATHER OUTAGES http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&ved=0CCgQFjAB&url=http%3A%2F%2Fenergy.gov%2Fsites%2Fprod%2Ffiles%2F2013%2F08%2Ff2%2FGrid%2520Resiliency%2520Report\_FINAL.pdf&ei=uAOqU4fYJYXroASWkoD4CQ&usg=AFQjCNFExUc4-H2WXFcT5Dv6I-tx6tSTuw&sig2=a1V\_oLWwSTCfhsVCBcYTyw&bvm=bv.69620078,d.cGU)

This report estimates the annual cost of power outages caused by severe weather between 2003 and 2012 and describes various strategies for modernizing the grid and increasing grid resilience. Over this period, weather-related outages are estimated to have cost the U.S. economy an inflation-adjusted annual average of $18 billion to $33 billion. Annual costs fluctuate significantly and are greatest in the years of major storms such as Hurricane Ike in 2008, a year in which cost estimates range from $40 billion to $75 billion, and Superstorm Sandy in 2012, a year in which cost estimates range from $27 billion to $52 billion. A recent Congressional Research Service study estimates the inflation-adjusted cost of weather-related outages at $25 to $70 billion annually (Campbell 2012). The variation in estimates reflects different assumptions and data used in the estimation process. The costs of outages take various forms includin lost output and wages, spoiled inventory, delayed production, inconvenience and damage to the electric grid. Continued investment in grid modernization and resilience will mitigate these costs over time – saving the economy billions of dollars and reducing the hardship experienced by millions of Americans when extreme weather strikes.

### Impact – Turns Case (Cost)

#### Grid connection costs prevent investment in offshore wind

Allen and Overy, 12 – (Allen and Overy, 08/17/2012, “Offshore grid connection”, <http://www.allenovery.com/SiteCollectionDocuments/Offshore%20grid%20connection%20-%20Draft%20bill%20for%20liability%20regime%20available_2012.pdf>)

Causes for the delayed connection are, aside from technical complications, especially the costly financing of the grid connection and the unclear legal status of who is liable in case of a connection delay. In this context, the transmission network operator TenneT TSO GmbH (TenneT) had clarified in a letter dated 7 November 2011, which is now known as "Brandbrief" (urgent letter), that the establishing of grid connections for offshore wind parks planned for 2012 and 2013 would overstrain the economical capabilities of the company. Due to these delays and the arising uncertainties for the operators of offshore wind farms (the Offshore Wind Farm Operators) several wind park projects are currently on hold.

### AT: Offshore Wind

#### Wind tech increases emissions – plan B fuel needed

Goodall & Lynas, 2012 (Chris Goodall and Mark Lynas, Guardian Reporters, September 26, 2012 “It's a myth that wind turbines don't reduce carbon emissions”, http://www.theguardian.com/environment/blog/2012/sep/26/myth-wind-turbines-carbon-emissions)

However, according to increasingly vocal critics of wind power, the intermittent nature of wind generation means we must burn more gas to provide backup. According to Telegraph columnist Christopher Booker: "Ramping the back-up gas plants up and down would mean running them very inefficiently, and give off so much CO2 that we could end up increasing our overall emissions rather than reducing them" Journalist and author Matt Ridley asserts that: "The total carbon emissions saved by the great wind rush is probably below 1%, because of the need to keep fossil fuels burning as back-up when the wind does not blow. It may even be a negative number." The climate-sceptic Global Warming Policy Foundation (GWPF) recently gave evidence to the House of Commons energy and climate change committee, stating: "There is a significant risk that annual CO2 emissions could be greater under the wind scenario than under the gas scenario". The essence of the wind sceptics' case is that a scaling up in wind power will have to be "backed up" by massive investment in gas-fired open cycle turbine (OCGT) plants, which are cheap to build but considerably less efficient than the combined cycle gas turbine (CCGT) power plants which deliver the vast majority of the UK's gas-fired electricity supply.

#### Renewables Raise CO2 Emissions - manufacturing

Tverberg, 01/23 - (Gail Tverberg, The Energy Collective Writer, January 23, 2014, “Ten Reasons Intermittent Renewables (Wind and Solar PV) are a Problem”, http://theenergycollective.com/gail-tverberg/330446/ten-reasons-intermittent-renewables-wind-and-solar-pv-are-problem)

I tend to use an even wider boundary approach: what happens to world CO2 emissions when we ramp up intermittent renewables? As far as I can tell, it tends to raise CO2 emissions. One way this happens is by ramping up China’s economy, through the additional business it generates in the making of wind turbines, solar panels, and the mining of rare earth minerals used in these devices. The benefit China gets from its renewable sales is leveraged several times, as it allows the country to build new homes, roads, and schools, and businesses to service the new manufacturing. In China, the vast majority of manufacturing is with coal. Another way intermittent renewables raise world CO2 emissions indirectly is by making the country using intermittent renewables less competitive in the world market-place, because the higher electricity cost raises the price of manufactured goods. This tends to send manufacturing to countries that use lower-priced energy sources for electricity, such as China. A third way that intermittent renewables can raise world CO2 emissions relates to affordability. Consumers cannot afford high-priced electricity without their standards of living dropping. Governments may be pressured to change their overall electricity mix to include more very low-cost energy sources, such as lignite (a very low grade of coal), in their electricity mix to keep the overall price in an affordable range. This seems to be at least part of the problem behind Germany’s difficulties with renewables.

#### OW Turbines Fail – ext.

Lau, Ma, and Pecht, 12 – (Bill Chun Piu Lau, Eden Wai Man Ma, and Michael Pecht, Centre for Prognostics and System Health Management City University of Hong Kong; Center for Advanced Life Cycle Engineering (CALCE) University of Maryland, College Park, 2012, “Review of Offshore Wind Turbine Failures and Fault Prognostic Methods”, http://www.prognostics.umd.edu/calcepapers/11.PDF)

Electrical control, gearbox, yaw system, generator, hydraulic, grid and blades are rated (60% of the total failures) as the most common failure components of wind turbines (>1.5MW) in the study of Danish turbines [6] (Figure 2). Those challenges cause extra cost on emergency maintenance, component screening, physical designs and so forth. According to the failed components mentioned, a more details are provided in the following with the failure mechanism(s) and cause(s) of the components. Therefore, prognostic methods can be customized for the specific components. A. Electrical Control Failures Damages of generator windings, short-circuit and over voltage of electronics components, transformers (Figure 3) and wiring damages are the common failures of electrical control [7]. These failures are reported as the results of lightning, poor electrical installation, technical defects and resonances within resistor-capacitor (RC) circuits [8]. B. Yaw System Failures Yaw control system controls the nacelle rotation to place the blades facing the desired angle [9]. It was reported that the cracking of yaw drive shafts, fracture of gear teeth, pitting of the yaw bearing race and failure of the bearing mounting bolts are all categorized as Yaw System Failures [10]. Icing problem in extreme weather [11] and high vibration level during overload [12] are also claimed as the cause of the failures. C. Gearbox Failures Gearbox is usually found in the turbines nowadays. However, it was one of the most frequently damaged rotational components in turbine. The failures are usually wearing, backlash, and tooth breakage (Figure 4). They are claimed as the result of particle contaminations, frequent stoppage and starting and high loaded operation conditions [7]. D. Grid Failures The wind speed and direction always change time after time. It is impossible to predict them accurately. If the region is highly dependent on wind power without any backup power storage or other power generation system, wind grid may occur during high power consumption with low wind power generation [13]. E. Hydraulic Failures Hydraulic components are used in many high pressure connections located in pitch, yaw, braking system and gearbox lubrication system. The leakages of these components are called hydraulic failure. Since the offshore turbines are usually located in extreme environmental conditions, the failure may occur during high/low temperature, corrosion, vibration. The reasons behind are claimed as improper installation, poor system design, poor component quality and system abuse. The improper installation rated as 60% of the total failure causes [14]. F. Blade Failures Blades are the main rotors of wind turbine and they transfer wind power into up-lifting force by fluid dynamic physical design. Usually, any blade damages, cracks, breakups and bends are said as blade failures. Causes of the blade failures include turbulent wind, out-of-control rotation, lightning [15] and production defects [16]. [4] reported that a broken blade had travelled as far as 1.3km from its tower. Many countries, hence, set up regulations to forbid their civilians to get close to wind farms such as US and Germany [17].

#### OTEC Safeguards to prevent overload – automatic disconnection

U.S. Department of Energy, 78, - (US Department of Energy, 1978, “Ocean Thermal Energy Conversion Power System Development”, http://books.google.com/books/reader?id=xIARAAAAYAAJ)

Some situations in which electrical load would be suddenly interrupted are: • While connected to land-based grid, if partial grid load is lost and the proper switching of load to other generating units does not take place, the OTEC system would be overloaded. This overload would disconnect the OTEC system from the land-based grid. • Any short circuit fault in OTEC network or in cable connecting to land-based grid would interrupt electrical load. If certain system components fail, turbine flow should also be quickly interrupted to prevent system damage. Some system mal functions which would require interruption of turbine flow are listed as follows:• Loss of turbine or generator bearing oil I Excess turbine or generator bearing temperatures • Excessive rotor vibration • Loss of gland sealing systems • Loss of electrical power to control system • Malfunction of turbine flow control valves• Malfunction of computer software in control system • Loss of control oil • Ammonia leakage

## Grid DA Answers

### Non-Unique

#### Read the “renewables now” cards from the Renewable Tradeoff DA

### AT: OTEC Link

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### AT: Offshore Wind Link

#### Intermittency only occurs on an individual scale – mass OW fields solves

Weaver, 10 – (Janelle Weaver, Wired Reporter, 04/05/10, “Chain of Offshore Wind Turbines Could Power Atlantic Seaboard”, http://www.wired.com/2010/04/wind-power-chain/)

A 1,550-mile-long network of offshore wind stations could provide power from Massachusetts to North Carolina with minimal threat of outages, according to a new study. By connecting stations together, the system could eliminate the biggest downside of wind power: intermittency. The concept is simple: If you spread out wind stations far enough, each one will experience a different weather pattern. So it’s very unlikely that a slackening of the wind would affect all stations at once. The result is steadier power. “We’re designing transmission in a different way, according to meteorological principles,” said marine-policy expert Willett Kempton of the University of Delaware in Newark, co-author of the research, published April 5 in the Proceedings of the National Academies of Sciences. Kempton and a team of scientists analyzed five years of wind data from 11 meteorological stations — buoys and towers — off the Atlantic coast, from Florida to Maine. They found that combining power from all stations with a transmission cable could prevent massive power fluctuations. The scientists simulated an underwater transmission cable, which they called the Atlantic Transmission Grid, that stretched more than 1,550 miles and connected all 11 stations. Although individual sites showed erratic patterns, the aggregate power output changed only very slowly. For example, the power output of individual stations would regularly drop to zero and fluctuate by more than 50 percent in an hour, but the output of the entire grid did not change more than 10 percent in any given hour. And the north-south orientation of the grid meant that a northward cyclone, which can cause wind power to drop quickly after it passes through, would affect only a few stations at a time. Grid power never dropped to zero during the entire five-year period. “We took an intermittent resource and made it not intermittent anymore,” Kempton said. Scientists had considered offshore wind as a potentially limitless source of power. Compared to land, the ocean has stronger and more constant winds, though still not constant enough to be a primary energy supply. This study indicates that offshore wind deserves more serious consideration as an energy alternative. “The technology’s there, the materials are there, we have the willpower to reduce carbon emissions, we have a reliable power supply that doesn’t lead to fuel shortage,” said Mark Jacobson, a civil and environmental engineer at Stanford University. “The next step is really to start implementing this on a large scale.” There are currently no commercial offshore wind stations, though companies have started developing six wind farms along the east coast. Together, the developments could produce as much energy as a large coal or nuclear power plant.

#### L/T: Wind tech actually enhances the Grid – Studies prove

Marcacci, 01/24 – (Silvio Marcacci , Clean Technica Writer, January 24th, 2014, “Forget Intermittency: NREL Says Wind Energy Can Boost Grid Reliability”, http://cleantechnica.com/2014/01/24/forget-intermittency-nrel-says-wind-energy-can-boost-grid-reliability/)

NREL undertook the study with the Electric Power Research Institute, an organization comprised of more than 1,000 members (most of whom are electric utilities) and the University of Colorado, so renewable energy naysayers will be hard pressed to dismiss this study as an environmentalist pipe dream. Analysts studied multiple power system simulations, control simulations, and field tests at NREL’s National Wind Technology Center to determine how if wind could provide ancillary services in wholesale electricity markets, how wind farms affect system frequency in the Western U.S. grid system, and if using wind farms to actively provide power control to the grid affects turbine performance and structural integrity. And the outcome of all these studies? Wind energy can not only support the grid by ramping power output up and down to enhance system reliability, but that using wind farms to provide active power control is economically beneficial, all with negligible damage to the turbines themselves. Wind Energy, Making The Grid Stronger and Cheaper. These are potentially game-changing findings. “The study’s key takeaway is that wind energy can act in an equal or superior manner to conventional generation when providing active power control, supporting the system frequency response, and improving reliability,” said Erik Ela, NREL analyst. Active power control helps grid operators balance system demand with generation at various times throughout the day, helping prevent power flow above or below the ideal grid frequency and involuntary load shedding – preventing both potential blackouts and turbine damage. Making America’s grid more flexible and integrating renewables is an important imperative. Without long-overdue transmission system investments, grid operators are often forced to use high-cost (and typically fossil fuel) “peaker” power plants when demand surges or baseload power plants go offline.

### AT: Link – General

#### HVDC tech solves Grid Failure issues

ABB, No Date - (ABB, No Date, “Connecting renewable energy to the grid”, http://www.abb.com/cawp/seitp326/377dbeff7a3a6aedc12577c20033dbf5.aspx)

HVDC is also the best technology for integrating more intermittent forms of renewable energy into the local power grid, particularly over long distances. This is especially significant for large scale offshore wind projects, or large scale solar power production. Technology of choice Offshore wind generation - particularly far out at sea where the wind is strong and steady - is an enormous potential power resource. For distances of more than 100 km or for large power levels, HVDC Light transmission has emerged as the technology of choice to link it to the grid. FACTS is a good option for shorter distances and lower power levels. For example, ABB has just built a 400-megawatt transmission link using HVDC Light technology for a wind park 130 kilometers off the German coast. When commissioned in 2010, wind-generated electricity from Borkum 2 is expected to displace. 5 million tons emissions each year by replacing electric power generated from fossil fuel on the mainland. With HVDC Light, high power levels generated offshore can be fed into the network without destabilizing it. Nor will intermittent offshore electricity generation disrupt the grid. HVDC Light transmission systems are also extremely efficient, with very low transmission losses, even over long distances. HVDC Light is also attractive for its simple-to-handle cable design and modularized, factory-assembled voltage converter, which means the network links essential to receiving power from offshore wind parks can be quickly installed and commissioned.